

Design Engineering

FIVE DOLLARS A YEAR



Laminated plastics

Hand controls

September 1958

"Aluminum!
...that gives me an idea!"



*"Lightness... strength... and no painting! That's a combination
I can use to advantage for MY business."*

Aluminum is showing up everywhere these days. This smart, light and strong pleasure craft is only typical of the increasing variety of fine products now being manufactured of ALCAN aluminum. The ever widening use of this versatile modern metal has been made possible because of the development of new alloys, improved fabricating and welding techniques, consumer demand and ALCAN "know how".

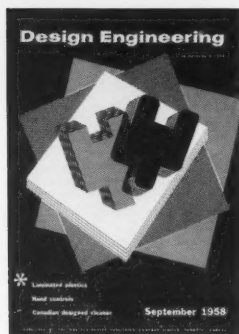
PERHAPS ALCAN ALUMINUM AND ALCAN "KNOW HOW" CAN HELP YOU IN YOUR BUSINESS...

ALCAN are the people to see about everything concerning aluminum. They are leaders in its development and set its standards of quality. ALCAN has over fifty years' experience in aluminum and is the major source in Canada for sheet, wire, rod, bar, foil, extrusions, castings and ingot.

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ALCAN



Design Engineering

Vol. 4

SEPTEMBER 1958

No. 9

This month's cover

Our cover artist for September is Gerald Bern once again. Subject of his work is this month's two-page data sheet giving design hints on the use of laminated plastics and the feature article that ties in with it (by Berry of Bakelite). Central figures are a "do" and a "don't" treatment of the same shape of stamping. Rounded edges indicate the preferred version — less chance here of flaking.

Design Engineering

MEMBER



Printed and published by Maclean-Hunter Publishing Company Limited. Editorial and Advertising Offices: 212 King Street West, Toronto 2, Canada. Address all correspondence: P. O. Box 100, Toronto, Canada. Horace T. Hunter, (Chairman of the Board); Floyd S. Chalmers, President; Donald P. Hunter, Vice-President and Managing Director.

Publishers of National magazines in Canada: Maclean's, Chatelaine, Canadian Homes and Gardens. Business newspapers in Canada: Canadian Hotel Review; Fountains in Canada; Heating and Plumbing Engineer; Bus and Truck Transport; Canadian Advertising; Canadian Automotive Trade; Canadian Aviation; Canadian Grocer; Canadian Machinery; Canadian Packaging; Canadian Paint and Varnish; Canadian Printer and Publisher; Canadian Shipping; Canadian Stationer; Civil Administration; Drug Merchandising; Canadian Electronics Engineering; L'Espresso; The Financial Post; Hardware and Metal; Marketing; Men's Wear; Modern Power; Painting and Decorating; Plant Administration; Le Quincaillier; Electrical Contractor; Style; Office Equipment & Methods; Home Goods Retailing; Photo Trade; Le Pharmacien; Building Supply Dealer. Business newspapers in U. S. and U. K.: Inland Printer, Rock Products, Concrete Products, British Printer.

OTHER SERVICES: The Financial Post Corporation Service; Canadian Press Clipping Service; Commercial Printing Division.

Offices at 1242 Peel Street, Montreal; The Burrard Building, 1030 West Georgia Street, Vancouver 5; Maclean-Hunter Limited, 125 Strand, London (Eng.)

Subscription rates: Canada \$3.00 per year, two years \$9.00, three years \$13.00. Single copy price, \$1.00. United States and Great Britain \$10.00 per year. Other countries \$20.00 per year.

CONTENTS

Features

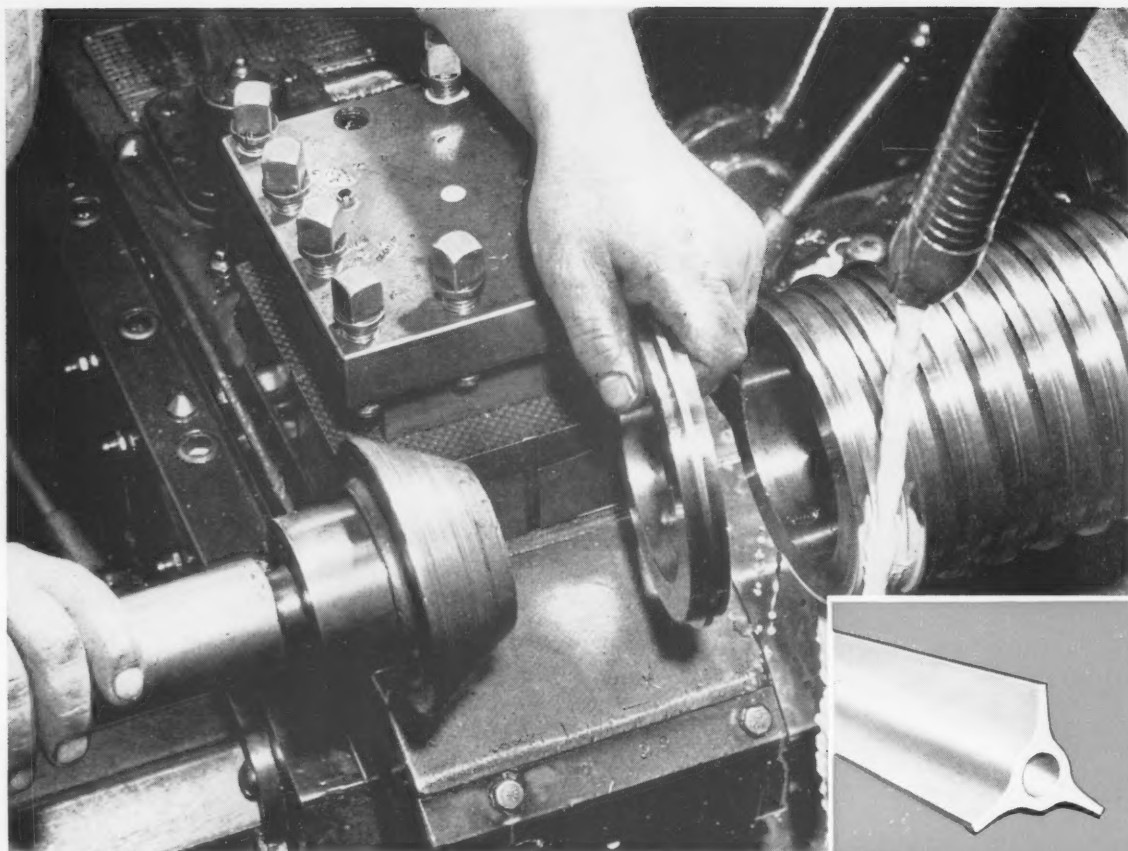
Vacuum die casting saves machining	45
Plastic laminates — strong and light	49
Hand controls designed to match a job	56
Tilting pads make up a generator bearing	60

Short features

Antifriction screw with dumb-bells	48
Portable sump pump	54
The new developments in torsion bars	55
Sixty second wonder — car from coffin	58
Glass in cordage licks heat problems	59
Nickel silver in powder metallurgy	62
Compound inhibits the formation of tenacious scale ..	63
Impact extrusions are filling new roles	70
Tunneled plate for rapid heat transfer	72
Sealing for high temperature systems	74

Departments

Authors	3
Briefs	76
Data sheet (laminated plastics design)	52
Design news in pictures	64
Editorial	92
Ideas round-up	66, 67, 68, 89, 90
New products	78, 80, 81, 84, 86
Reader service card	87
Reports	5, 6



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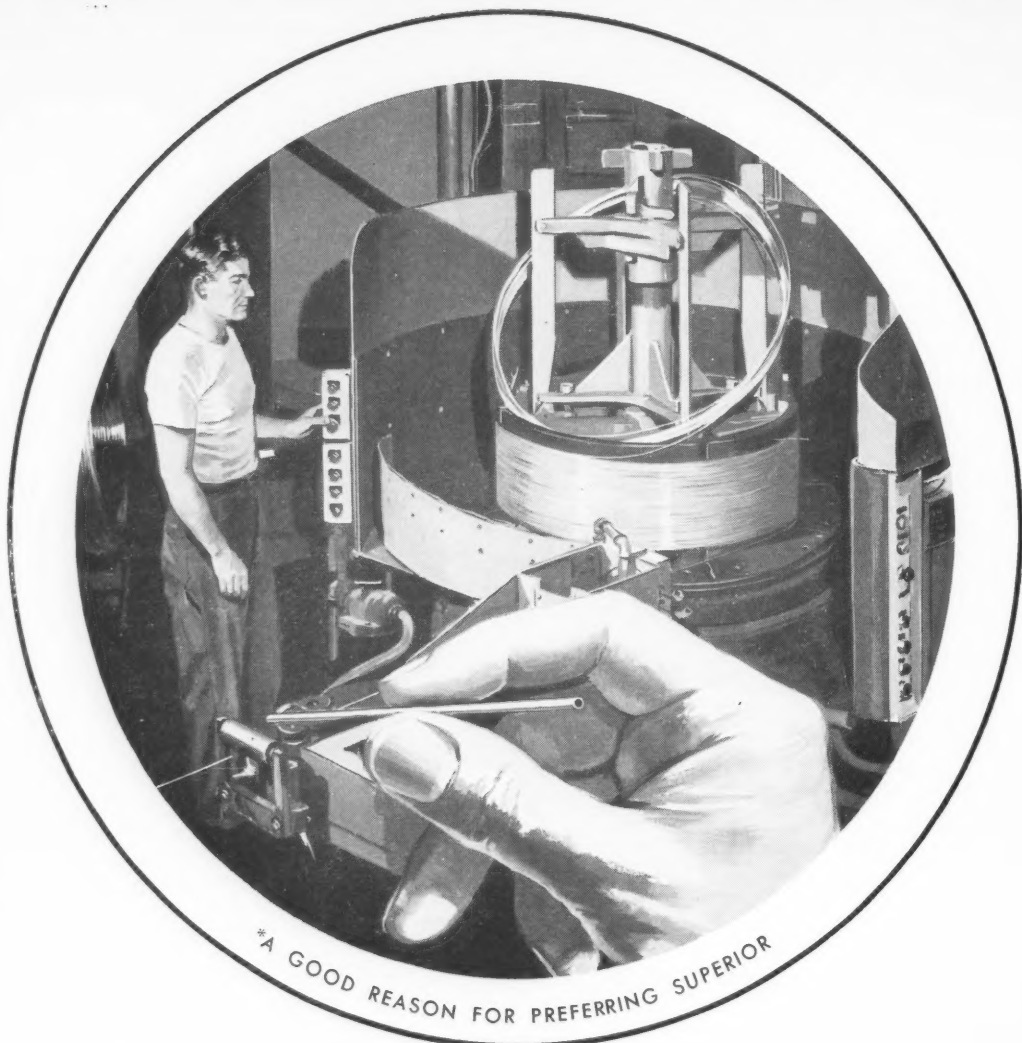
BERRY

W. S. Berry (Plastic laminates — strong and light) is with the Bakelite Co. in Toronto as thermosetting sales manager. He joined that company in 1945 as technical representative after serving in the RCAF. Since '45, Berry has had wide experience servicing customers in Quebec and Western Canada as well as Ontario. He's a member of the Society of Plastics Industries and the Society of Plastics Engineers.



WITT

Douglas R. Witt (Hand controls designed to match a job) is a freelance industrial designer and a director of Imagination Unlimited, an organization directed toward industrial design and the promotion of manufactured products through visual communications. A married man with a small son, Witt finds his recreation in watercolor painting, fishing and the writing of articles about the great outdoors.



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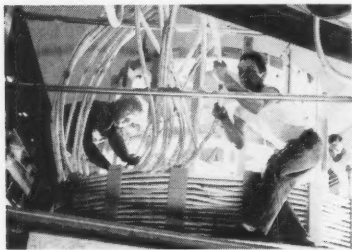
All analyses .010 in. to $\frac{3}{16}$ in. OD—certain analyses in light walls up to $2\frac{1}{2}$ in. OD

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Send me a copy of new Data Memorandum 11, on capillary tubing.
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Company _____
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Reports

A news roundup of items of engineering and design interest from the world over

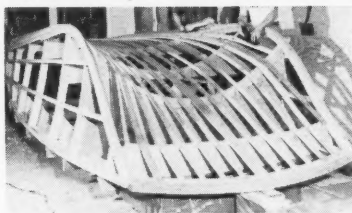
Inductance coil moves hot gas at over 32,000 mph



This huge inductance coil is used to supply energy to an electric-arc tunnel for testing missiles. Here's how it works.

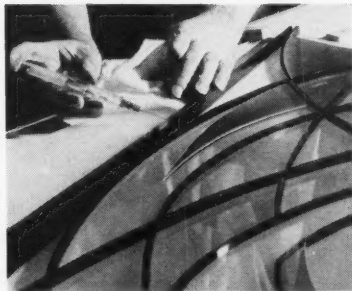
Energy is stored in the coil when its field is built up by a dc source; the arc chamber circuit is closed at this time. Contacts in series with the coil are then opened. An arc is produced in the chamber by the instantaneous collapse of the strong magnetic field in the coil. This heats the air in the arc chamber to 40,000F and raises the pressure to 30,000 psi. The plastic seal vaporizes, releasing a blast of hot gas which rushes through the test section and into the vacuum chamber at 32,400 mph. The coil is the largest ever built.

Speed and safety are dividends the sea-sled offers



Taking shape in the basement of a Vancouver surgeon, Dr. R. H. Marshall, is this outboard cruiser with a 20-ft seasled type hull. Claims for the seasled are for more boat in limited length and a safer and faster one in heavy seas. Hulls of this type gather water and air under them and ride on their own bow wave, reducing resistance. Roughly speaking, the seasled design is what might result from slicing a conventional hull down its centre and joining the two halves together again with the centre faces now outwards.

Brooklyn mural promotes plastic-working to an art form



Establishing a foothold for plastics in the field of art are two large decorative panels flanking the main entrance of the recently dedicated Brooklyn Polytechnic Institute. These are the work of muralist Abraham Joel Tobias who created them by fitting together thousands of pieces of plexiglas acrylic plastic.

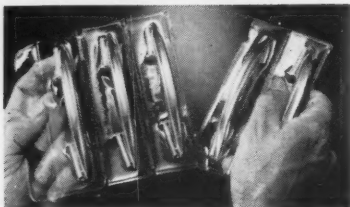
Approximately 3,500 pieces in 58 colors and shades were used. Each mural is 10 ft tall by 3 ft wide and there are multiple layers in some sections of the panels to achieve a three-dimensional appearance and to obtain subtle variations in color. During the day, outside light passes through the translucent panels, making them glow when viewed from the inside. At night, lobby lighting passes through the panels to the outside, making them glow when viewed from the street.

Dream car has the lemon-in-mouth Edsel look



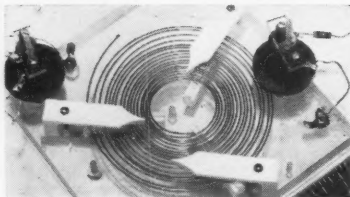
The E196X could have a marked influence on the styling of future models. So says George W. Walker, vice-president and director of styling with the Ford Motor Company. The "dream car" in question is shown here in a $\frac{3}{8}$ scale advance styling model. Obviously drawing a great deal of its inspiration from the current Edsel, this car carries on its vertical front-end theme. Front windshield posts have been eliminated and "the radiator opening has a jet-pod appearance." To us, it looks like the face you make if you forget to sweeten the lime rickey.

System gives the "skin-tight" look to plastic packaging



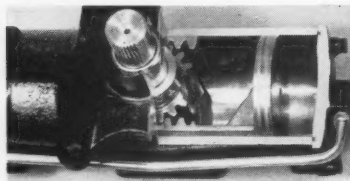
Eastman Chemical Products, Inc., demonstrated a new transparent plastic packing system in San Francisco recently. Butyrate plastic sheet is heated and drawn down skin-tight over the products being packaged so that they are enclosed and held securely by the clear plastic. The new method eliminates the necessity for any kind of backing board, with resulting savings in material and labor. The Butyrate plastic is highly resistant to aging, and the elimination of backing avoids the warpage that may occur when paperboard is used for this purpose.

A delay line that packs itself into a small volume



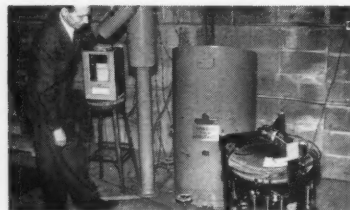
A delay line capable of providing a long delay in a small space has been developed by the Bell Telephone Laboratories. Known as a spiral coiled wire torsional wave delay line, it permits the clear resolution of 10 microsecond pulses spaced 20 microseconds apart. Delay lines are useful in many applications such as computer memories, trigger delay circuits, range measurement circuits in radar installations and in pulse decoding systems for electronic switching. The packaging of these delay lines in a small volume is important.

Opposed pistons convert hydraulic pressure to torque



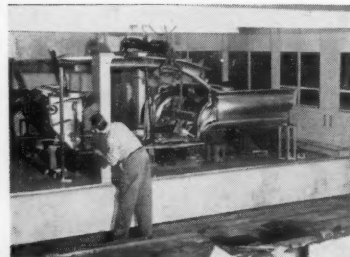
This small power cylinder is a compact and effective device for converting up to 700 psi hydraulic pressure into a torque of 26,000 lb-in. Hydraulic pressure on the horizontally opposed pistons makes the two racks drive a common pinion and, from it, an external short splined shaft. This item is made in the U. S. and further information on it may be obtained by circling No. 208 on the Reader Service card towards the end of this issue.

Light that's stronger than the sun's measures cloud height



The Department of Transport has purchased a German-designed "Ceilometer" for installation at Malton Airport. Light stronger than the sun is reflected as a beam against the base of a cloud layer. A receiver scans the beam, locates the intersection with the cloud base and then transmits the information to the recorder where it is automatically translated into feet and printed on a special paper strip. The light force of the unit is about 400 billion candlepower, and of a duration of less than one millionth of a second.

Level and square, granite weighs in at 27½ tons



A "world's largest," U. S.-made but Canada-installed, is this giant granite surface plate at the Oakville plant of the Ford Motor Company. It is large enough to carry a full sized automobile for accurate checking and measures 20 ft x 10 ft x 20 in. with a weight of 27½ tons. Its surface is finished so that it is flat within .002 in. Fitted with graduated steel straight edges running the length and width of the plate, the sides are paralleled within .010 in. and the ends square with the sides within .010 in. Although the largest surface plate in existence, it is by no means the largest possible. Solid sheets of granite up to 10 ft thick and as large as a football field are available.

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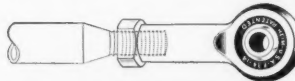
End fittings — method of attachment to adjacent operating units.

The majority of rods used in linkages have male threaded ends to which an adjustable rod end bearing is attached. The rods may also be female threaded with a Heim Unibal male rod end bearing. This type of assembly presents some advantages in that the smallest diameter of the Unibal may be closer to the point of attachment.

See illustration of both methods.



Female threaded rod with adjustable male unibal rod end bearing



Male threaded rod with adjustable female unibal rod end bearing

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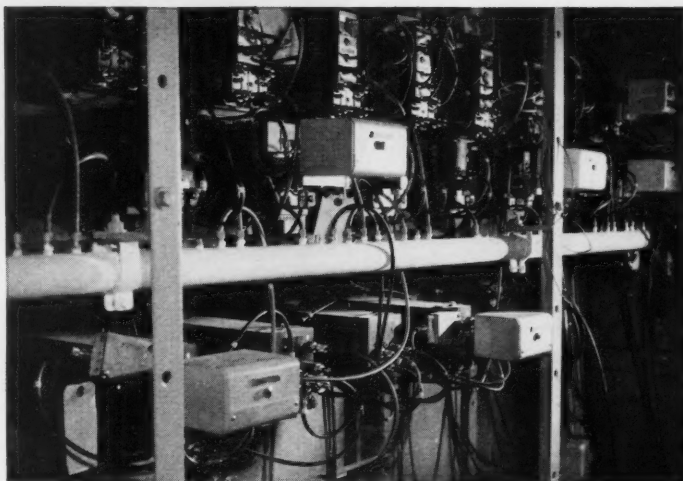
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VERSATILITY . . . the field of application for this fabulous fitting is growing by leaps and bounds. The *Poly-Flo* has been enthusiastically accepted and widely adopted for use with polyethylene and other plastic tubing in instrumentation, chemical plants, refineries, metal working plants and paper mills, to mention a few.

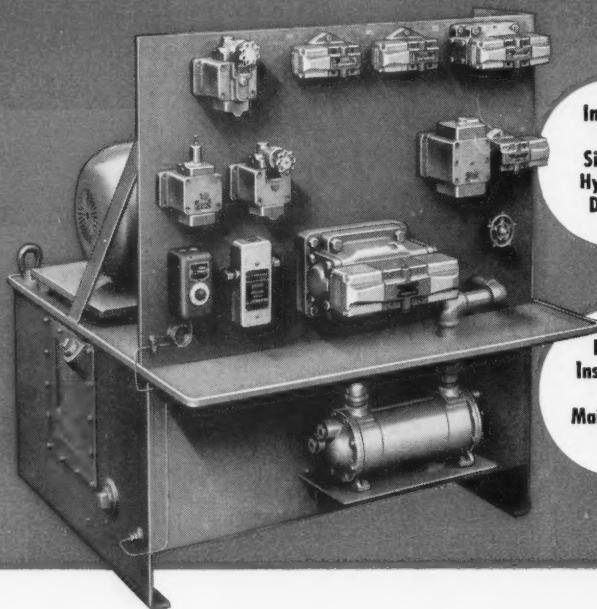
FITTINGS AND TUBING furnished in 1/4", 5/16", 3/8" and 1/2" O.D. sizes. Tubing supplied in 9 colors — color coding quickly identifies circuits. Recommended for working pressures to 125 psi. — 1/4" O.D.; 160 psi. — 5/16" O.D.; 100 psi. — 3/8" O.D.; 75 psi. — 1/2" O.D. Temperatures from -90° F. to +175° F. Tubing is very tough and impervious to most chemicals.

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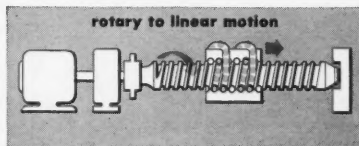
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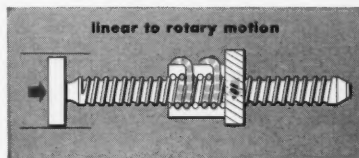
These amazing little fellows are so compact and weigh so little—you can save greatly on space and weight. So efficient—over 90%—you can use much smaller motors and gear

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ball/bearing Screw

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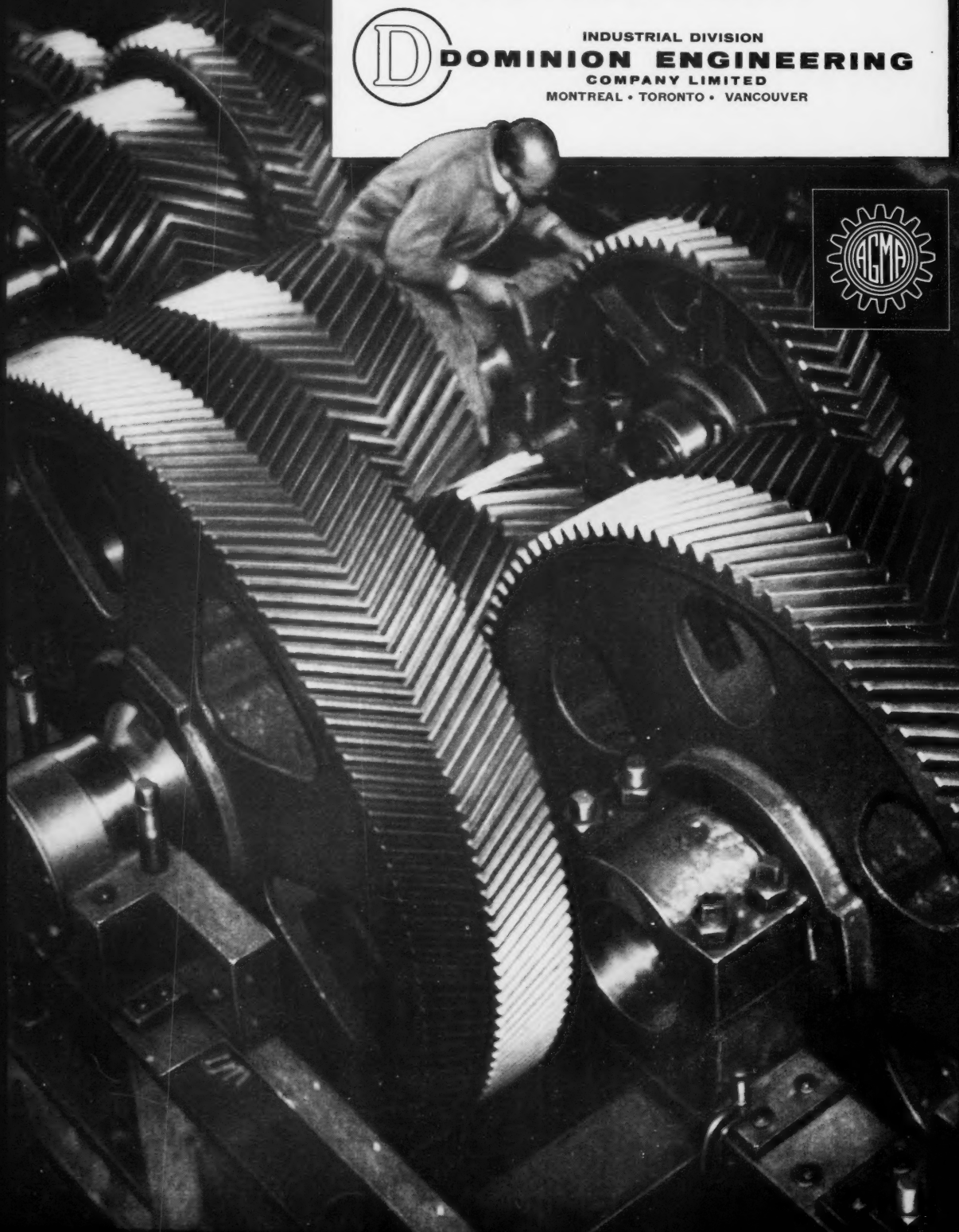


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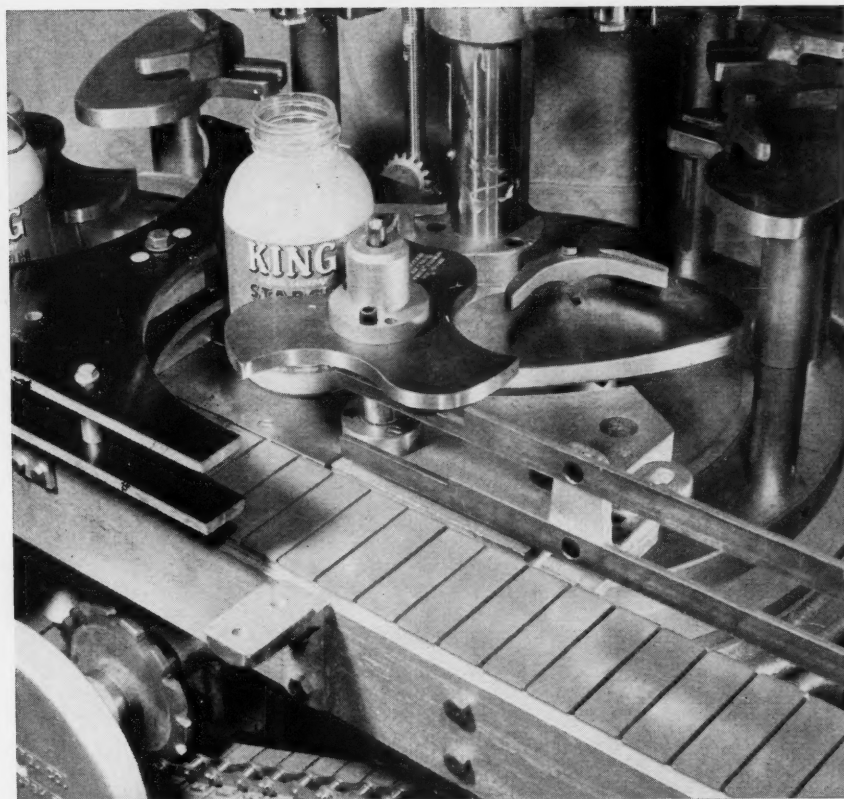
DOMINION ENGINEERING

COMPANY LIMITED

MONTREAL • TORONTO • VANCOUVER



New chain has steel's strength plus nylon's wear resistance



NY-STEEL FLAT TOP CHAIN on Horix Fitting Machine with nine fitter valves. This unit is in service at Mangels Herold Company, manufacturers of King Liquid Laundry Starch.

Link-Belt Ny-Steel flat-top chain fits existing sprockets

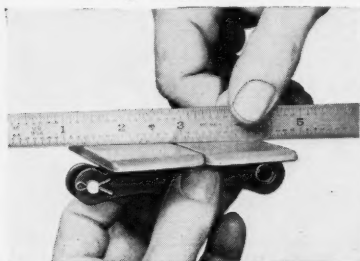
Nylon and Steel—Link-Belt combines both in Ny-Steel Flat-Top Roller Chain. This combination gives you a smooth, resilient nylon carrying surface to reduce glass breakage and track wear—plus a precision steel roller chain with the strength and durability to carry heavy loads without stretching. Ny-Steel is less than half the weight of similar all-steel chain—has proven itself ideal for safe, low-cost conveying of bottles, cans and similar items.

Exceptional wear-life

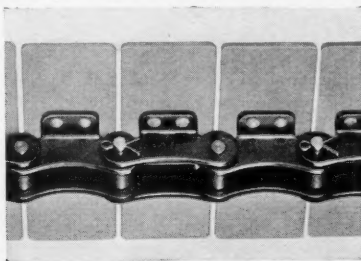
Long life is one of Ny-Steel's many outstanding features. It resists chemicals and corrosion . . . retains pitch, even under moisture conditions . . . gives long-lasting service with practically no top-plate or track wear.

Ny-Steel is easy to install . . . fits existing sprockets. And for new installations or replacements, Link-Belt makes a full line of cut-tooth sprockets. Ny-Steel comes with top plates assembled on either stainless or heat-treated carbon steel chain.

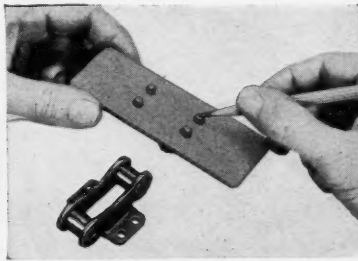
Why Ny-Steel is industry's most advanced flat-top conveyor chain



RIVET-FREE SURFACE—Top plates are of uniform thickness, without rivet pockets or projections. Each is chamfered and mounted level with adjacent plates.



PRECISION STEEL ROLLER CHAIN gives Ny-Steel its great strength . . . facilitates installations and maintenance. Can be easily coupled or uncoupled.



SECURE BONDING OF CHAIN AND PLATE—Underside of each plate is molded with projections that become self-ripping. This leaves surface free of obstructions.

The large picture above illustrates one of many applications of Ny-Steel flat-top chain. Besides being smooth, nylon plates are shock-absorbent . . . assure safe, easy transfer of containers.

Ny-Steel top plates are available in 3¼ and 4½-in. widths. Folder 2492 contains complete dimensions and specifications.

HEADQUARTERS FOR CHAINS, SPROCKETS is your nearby Link-Belt factory branch store or authorized stock-carrying distributor. Write for Catalog 900.



LINK-BELT LIMITED: Scarboro Plant, General Offices and District Sales—Scarboro, Ont., Station H, Toronto 13 • Eastern Avenue Plant and Factory Branch Store—Toronto 8 • Sales Offices and Factory Branch Stores—Montreal 15 • Vancouver 12 • Winnipeg 10 • Swastika, Ont. • Halifax: Austen Bros. Ltd. • District Sales Offices—Hamilton • Sydney: Austen Bros. Ltd. • Foundry at Elmira, Ont. 14,745-C

LINK-BELT
CHAINS AND SPROCKETS



NOW!



A FULLY-ADJUSTABLE, ULTRA-SENSITIVE RELAY

WESTON'S NEW LOW-COST SENSITROL RELAY PROVIDES A WIDE RANGE OF OPERATING VALUES

Weston introduces another important 'first': an all-purpose, fully-adjustable, sensitive relay. Available from stock and at low cost, it greatly simplifies many of the problems of engineers, designers and builders of alarm or control devices.

In breadboard circuits, the new SENSITROL relay makes it unnecessary to pinpoint electrical operating values through elaborate calculations or measurements. A single, movable contact adjuster provides an almost infinite number of accurately repeatable settings. In production equipment, the SENSITROL can eliminate the need for stocking a variety of relays.

A pair of SENSITROLS connected in opposition can provide close high-low control, adjustable over a wide range. The new relay can also be used for continuous pulsing control, or in a sensing control circuit to hold variables such as temperature, voltage or light level constant within very narrow limits.

SENSITROL relays contain built-in, re-set mechanisms and feature locking magnetic contacts. They can be set to close at any value of D-C from 5 to 50 micro-amps, or a comparable millivolt span of 10 to 100 . . . and will handle 100 milliamps at 120 volts A-C without chatter.

For complete information write to Daystrom Limited, 840 Caledonia Road, Toronto 19, Ontario; 5430 Ferrier Street, Montreal 9, Quebec. A subsidiary of Daystrom, Incorporated. Or any office of Northern Electric Co. Ltd.

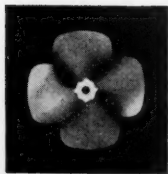
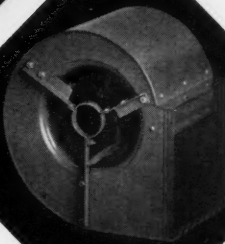
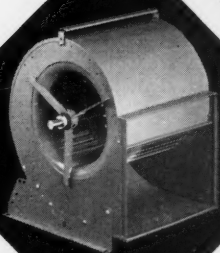
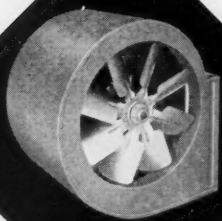
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BE SURE TO VISIT US AT THE IRE SHOW — BOOTH NO. 142.
ALSO BOOTH E-26 FOR THE HEATH STEREOPHONIC DEMONSTRATION.

WESTON

Instruments





FULL COVERAGE

No matter which way the wind blows with your blower unit requirements—belt-driven, direct drive or radial-axial mixed flow—Torrington has the solution to your problems.

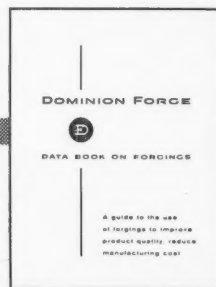
This means complete technical data and the proved-out performance rating on three lines of basic blower unit designs.

In addition to the standard direct drive units and the already famous VariBasic belt driven series, latest and most spectacular addition is the exclusive Radiax unit, combining the optimum performance characteristics of both radial and axial flow techniques.

*The result is **FULL COVERAGE**—the best "problem insurance" you could have. Talk to Torrington!*

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Test-step towards a better finish . . . in the Glidden Technical Service Department a refrigerator door is test-sprayed under conditions simulating actual production line conditions.



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This Booklet outlines all Glidden Technical and Laboratory Services—and how you can profit by them. We will gladly send a free copy to plant executives on request. Just write to:



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When Glidden works with you to develop a finish for your product, you can use it confidently on *your* production line. Time and money-wasting hold-ups involving finishing problems are reduced to a minimum under the Glidden plan! When we are asked to develop a finish, we study your product requirements, your production schedules and equipment.

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Before it leaves us, we make absolutely sure that the finish we have produced meets *your* requirements.

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Let us take extra steps for you—towards more economical, durable and better finishes! Please contact our service representative or write to us direct.

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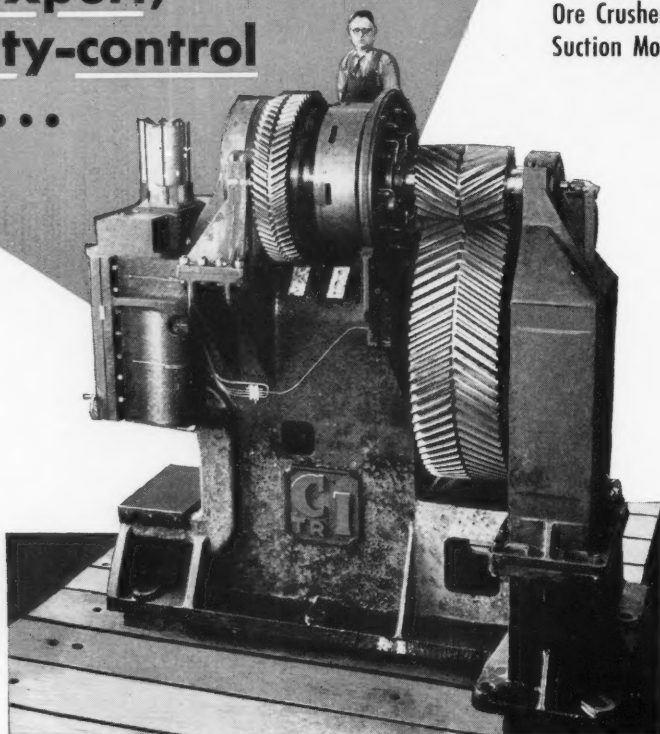
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Technical Service Department • 351 Wallace Ave., Toronto, Ont. • 133 Elmslie St., Ville la Salle, Montreal 32, P.Q.

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A 116,000 lb. Tie Plate Shear for a Canadian steel company is checked in Canada Iron's shops. Shown before assembly of gear guards and final painting, the huge tie plate shear incorporates a special air clutch for engaging the gears.



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Take advantage of Canada Iron's many years of engineering experience. Bring your problems or your blueprints to Canada Iron's Engineering Staff for the best and most economical solution.



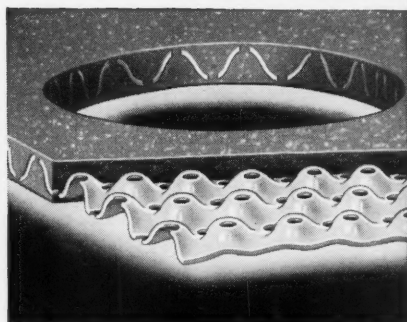
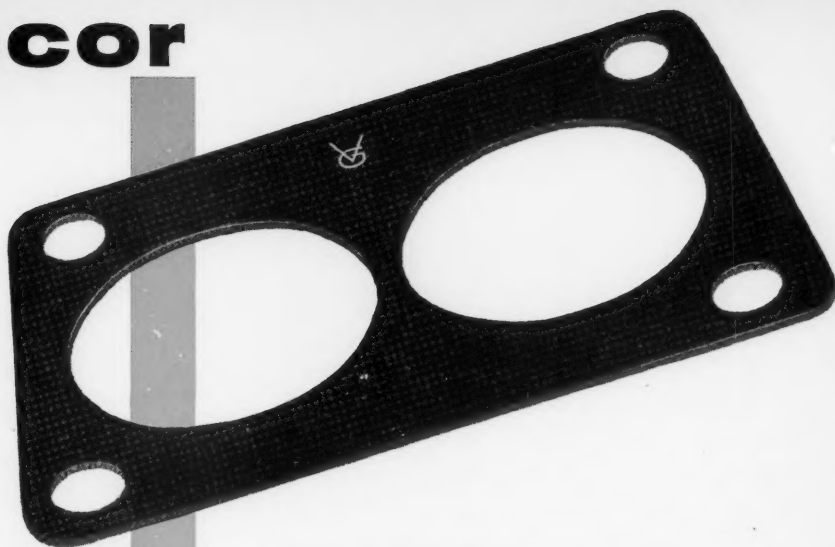
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Victocor

new
super-
sealing
gasket
material



Cross section of **Victocor**. Thin steel core is die-formed with continuous projections alternating in each face. (Type 200 core has 800 projections per sq. in.) Sealing element layers, top and bottom, are bonded simultaneously with core into integral structure. Deep penetration of core projections increases stability and heat conductivity.

TYPICAL PHYSICAL PROPERTIES — TYPE 200

Thickness	.030/.035" min.
% Compressibility at 1000 psi.	*10-15
% Recovery at 1000 psi.	35 min.
% Compressibility at 5000 psi.	*16-21
% Recovery at 5000 psi.	30 min.
Service temperature	750 deg. F.
Crush resistance psi.	100,000
Corrosion resistance against aluminum, magnesium, steel and copper	Good

*Slightly higher values are obtained with heavier gauge.

... where you need these
maximum characteristics

- low torque loss
- high heat resistance
- high crush resistance
- high dimensional stability
- thin construction—.030/.035 gauge

Victocor justifies re-examination of your most exacting sealing specifications. It's a totally new product—offers more in every desirable heavy-duty characteristic.

Victocor was developed particularly for high-flange-pressure applications. Its steel core construction accelerates heat conductivity. It is strong and highly flexible.

Resistance to hot oils, gasoline and water is excellent, and **Victocor** positively retains all commonly used coolants.

Victocor's sealing element—a special asbestos-elastomeric compound—is extremely resilient. It helps compensate for mating surface irregularities. No coating is required when installing **Victocor** gaskets, and they're easily removed for replacement.

4 Standard Types Available—Test Samples Free

Where can you seal better and more economically with **Victocor**? Let Victor engineers help you decide. It's available in four standard types and many modified combinations. Meanwhile, write for complete technical data and free test samples. Please mention proposed application. Address the factory, or contact your Victor field engineer.

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This new Guide to Gear Lubrication saves time, money and headaches

**FARVAL—
Studies in
Centralized
Lubrication
No. 195**

FARVAL SPRAY VALVES

ADAPTABLE TO YOUR SPECIAL NEEDS

SOLVE HARD-TO-HANDLE LUBRICATION PROBLEMS
With the development of the Farval spray valve and of a spray lubrication system, Farval overcomes the most difficult lubrication problems. The particular lubrication requirements of each machine are met by the spray valve. Whether the machine has a single or multiple lubrication points, the spray valve can be adjusted to spray the oil exactly where it is needed. The spray valve is a more convenient lubrication method than any other.

PICK ANY MEASURING VALVE
The complete line of Farval measuring valves is available. They are designed to measure the flow of oil or grease through the spray valve.

BULLETIN 60-A

The Safe-Sure Method for GEARING PROTECTION

FARVAL SPRAY VALVES

A FORWARD STEP IN CENTRALIZED LUBRICATION

SOME ENGINEERING CONSIDERATIONS

SPEC:
After direct observation data, the Farval spray valve is the most reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

PITCH DIAMETER
The pitch diameter of the gear is the most important factor in determining the correct spray valve. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

GEAR FACE
The gear face is the most important factor in determining the correct spray valve. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

LUBRICANT AND TEMPERATURE
The lubricant and temperature are the most important factors in determining the correct spray valve. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

GEAR GUARDS
The gear guard is the most important factor in determining the correct spray valve. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

POINT OF APPLICATION
The point of application is the most important factor in determining the correct spray valve. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

AIR SUPPLY
The air supply is the most important factor in determining the correct spray valve. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

PRESSURE
The pressure is the most important factor in determining the correct spray valve. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

PURITY
The purity is the most important factor in determining the correct spray valve. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

CYCLE FREQUENCY
The cycle frequency is the most important factor in determining the correct spray valve. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application. It is a simple, efficient, and reliable method of oil or grease application.

● If you design, build or use equipment with large gears, you will want Bulletin 60-A. Its 8 pages provide full information on Farval Spray Lubrication Systems available for manual or automatic operation.

Farval Spray Valves are completely flexible. They can be used alone, in panel set-ups mounted on gear housings, or as part of a Farval Dualine System—wherever compressed air is available. As with standard Dualine valves, the spray can be operated as often as needed to deliver any amount of oil or grease—on gears, slide surfaces or other areas needing lubrication.

Thousands of Farval Spray Valves are used in many industries. You, too, should enjoy their benefits. Write today. You will receive a copy of Bulletin 60-A and the address of the Peacock representative in your area who can help you select the proper equipment for your machines. Peacock Brothers Limited, P.O. Box 1040, Montreal 3, Que. Branches in Sydney, Toronto, Sudbury, Winnipeg, Edmonton, Calgary, and Vancouver.


Proved in 30 years of service, Farval manual and automatic centralized lubrication systems protect millions of industrial bearings. Wherever you see the familiar Dualine valve manifolds, dual lubricant lines and central pumping station, you know a machine is being properly lubricated.



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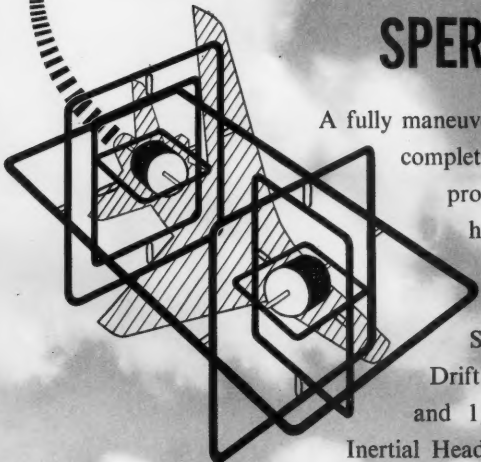


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A fully maneuverable twin gyro platform, utilizing completely new gyro design principles and providing unprecedented accuracies in heading information and all-attitude flight, will soon be ready for flight trials. Features of the Sperry Stable Platform are:— Low Random Drift (as low as $\frac{1}{4}^\circ$ per hour in azimuth and $1/10^\circ$ per minute in the vertical); Inertial Heading; Great Circle or Rhumb Line Output; No Gimbal Error; Low Turning Error; Multiple Roll-Pitch-Heading Output; No Warm-up Time. This Sperry Stable Platform is especially adaptable for Low Altitude Bombing Systems, fighter manoeuvres and missile applications.

Sperry engineers are continually striving to aid the advance of aviation through the creation of better systems and equipment.



SPERRY GYROSCOPE COMPANY OF CANADA, LTD.

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Roller chain sprockets

Taper-Lock Roller Chain Sprockets are a new, patented, advance in sprocket design. These sprockets require no rebor-ing, keyseating or setscrew machining. Easily mounted or removed with a hex wrench, Taper-Lock grips the shaft with the firmness of a shrink-on fit. These units are the most economical, safe and compact sprockets available today.



No. 201

Roller chain

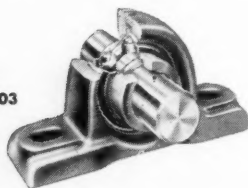
Precision construction and carefully tested materials are important features of this high quality roller chain. This chain is available in all pitches and lengths and in many varieties of construction and strength for every type of transmission service.



No. 202

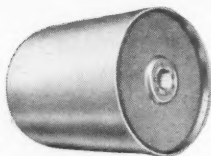
Wide inner ring bearings

Wide Inner Ring Ball Bearings with new **Plya-Seals** are especially developed to give dependable service under conditions of extreme contamination, even at very low speeds. The unit is available in both relubricatable and non-relubricatable types in bores from 1/2" to 2-15/16".



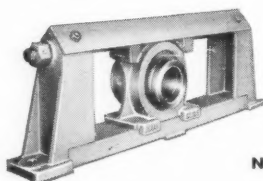
No. 203

No. 204



Welded steel conveyor pulleys

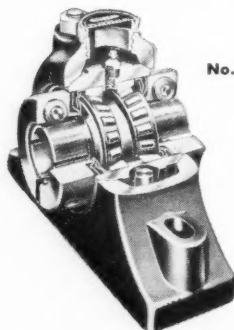
Taper-Lock Welded Steel Conveyor Pulleys incorporate new patented design features which make them significantly superior, to bolted hub pulleys. The drum type construction combines great strength with light weight. Every weld in the Taper-Lock Pulley is made by "submerged arc process", giving strong deep welds. The Taper-Lock feature makes these pulleys more compact, neater and easier to mount and remove.



No. 205

Protected screw take-up

The Style KF Horizontal Protected Screw Take-up with anti-friction bearing is a rugged unit, practical for every type of medium to heavy duty service. They are available for shaft diameters from 1-15/16" to 3-15/16" and from 9" to 36" travel. A Plain Bearing style (K) is also available in the full range of sizes.



No. 206

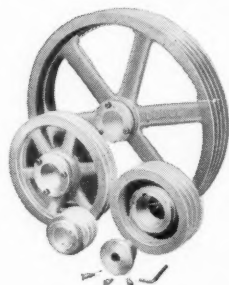
Roller bearing pillow block

The Type C. (Dodge-Timken) Roller Bearing Pillow Block offers maximum protection where dust or other contamination is unusually severe. The Basic

design consists of two Timken assemblies mounted on a slotted and threaded sleeve. These slotted ends are clamped to the shaft by means of split clamp collars. (The collars, threaded to the sleeve also provide means of adjustment.) Labyrinth seals are located between the collars and the Timken Bearing. The Type C unit is complete self-aligning and provides for both radial and thrust carrying capacities. Available for shaft sizes from 1-3/16" to 5".

V-Belt sheaves

Standard Sheaves, using split-taper bushings, are easier to mount and require no special tools. The split bushing grips the shaft with a positive, clamp on fit. Stock sheaves are available up to 50" outside diameter, 12 grooves wide. Fractional Horsepower and Made-to-order sheaves are also available.



No. 207

All of the items illustrated here are available for immediate delivery from stock at United Steel Corporation. These are just a few items from our tremendous range of mechanical power transmission equipment. Our warehouses are located at strategic points across Canada. Our staff of transmission experts is ready and waiting. Drop us a line or fill in the coupon below for an answer to your transmission problems.

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warehouse a modern
building of practical,
lasting beauty



This Montreal warehouse of Atlas Steels Limited clearly demonstrates the striking beauty that can be achieved through the use of stainless steel containing nickel. What's more, it's a highly practical building material—strong, durable, easy to keep clean. It's rustproof and extremely corrosion resistant. It needs no painting, polishing, waxing or lacquering. *Superior insulating properties of curtain-walling reduce heating costs substantially.*

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Nickel helps give stainless steel its exceptional strength and its resistance to corrosion . . . makes it easy to fabricate. For additional information on the use of stainless steel as an architectural material, write to Inco at the address below.



Inside the Atlas Steels Limited warehouse, stainless steel containing nickel adds bright beauty and lasting service in stair rails and trim.

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Hamilton

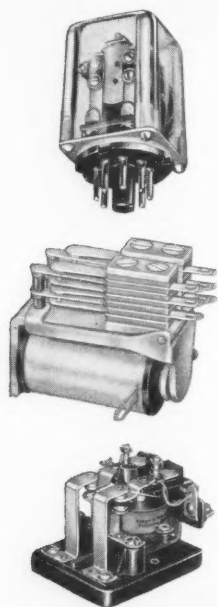
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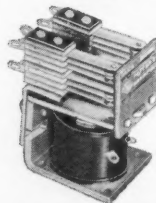
RELAYS BY POTTER & BRUMFIELD



P&B relays are now being made on a limited scale at Guelph, Ontario. In time, we plan to manufacture our complete line in Canada, for Canadian use.

Meanwhile, a full stock of standard relays, more than 480 variations of 57 basic types, will be maintained at Guelph. These standard relays are available "off the shelf" at franchised P&B distributors throughout Canada.

Whatever your relay requirements may be, your inquiries will be welcome. Send today for our latest catalog... or contact the P&B Canadian Sales Representative nearest you.



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POTTER & BRUMFIELD CANADA LTD.
GUELPH, ONTARIO

*Scrivener's Parking Building,
Baltimore. Aluminum paneling is
treated with beautiful
Bonderite Architectural Green.*



sheathed in aluminum... and protected by **Bonderite Architectural Green**

You'll see many more buildings, like this attractive structure in Baltimore, using aluminum finished with Bonderite Architectural Green. There are so many things to recommend this beautiful, durable Bonderite coating!

Treatment with Bonderite Architectural Green protects aluminum from corrosion. The same protective treatment chemically produces a soft, lasting green color which is a part of the integral coating of the metal surface. Color is sun-and-weather-fast.

Bonderite Architectural Green costs far less than electrolytically produced color coatings for aluminum. It is simple to use, and the color uniformity is a sure visual

check on the uniform quality of the coating, maintained in volume production day in and day out.

Bonderite Architectural Green may be applied by spray or immersion, and by continuous strip treatment.

Metal treated in this manner can be used not only in construction panels, but also for siding, awnings, venetian blinds and many items on which the excellent color and durability contribute to a better, more salable product.

Write for descriptive illustrated booklet "Bonderite 700 Series". Details on Bonderite Architectural Green, uses, advantages, characteristics.



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PARCO LUBRITE heavy duty maintenance
wear resistant for friction surfaces
TROPICAL paints since 1883

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corrosion resistant
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of metals

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problem
a MESH?



... then check the amazing versatility of



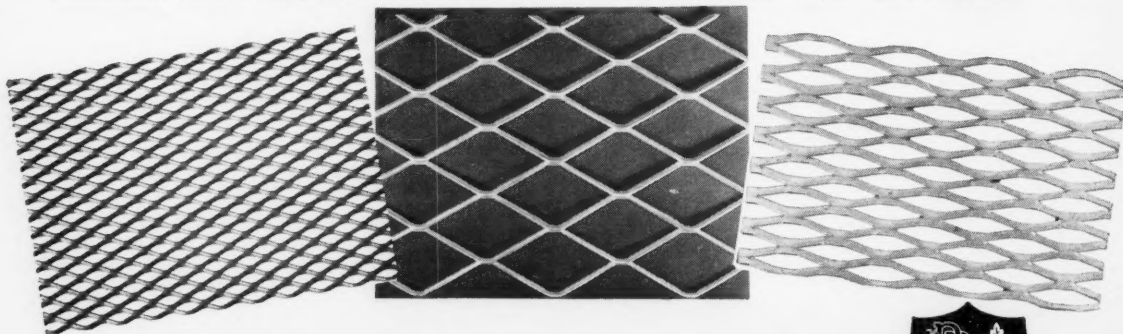
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EXPANDED metal

**INCREASED STRENGTH—REDUCED WEIGHT
FLEXIBLE IN DESIGN—VARIED IN APPLICATION**

You name it . . . Pedlar Expanded Metal will build it. It's one fast, sound, money-saving solution to a thousand problems. Expanded Metal gives designers and builders unlimited leeway to develop modern, practical, amazingly serviceable products for industry and the home. It's light and airy . . . ideal for trays, bins, ventilators; yet it's ruggedly strong for sturdy

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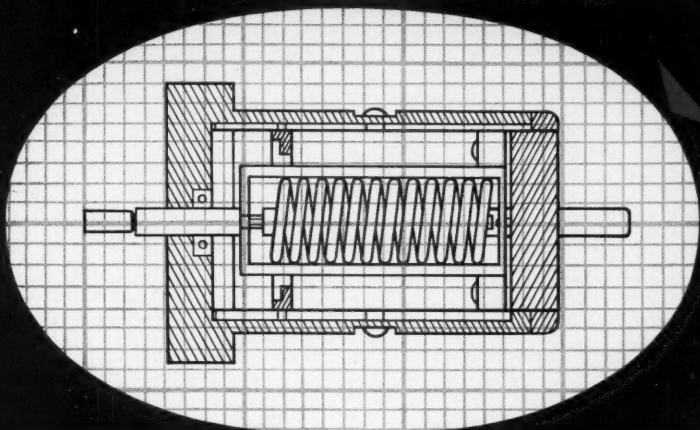
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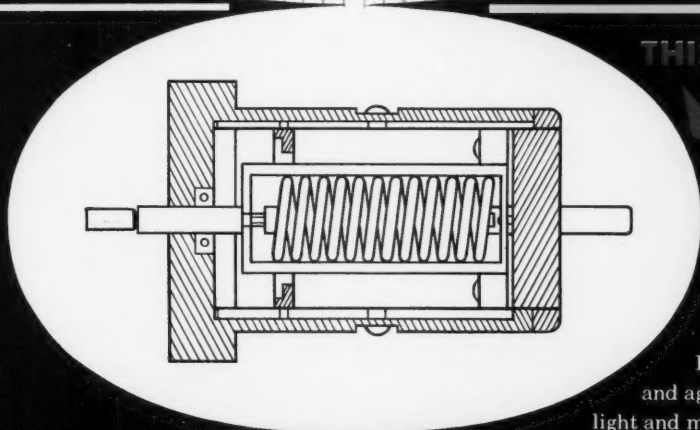
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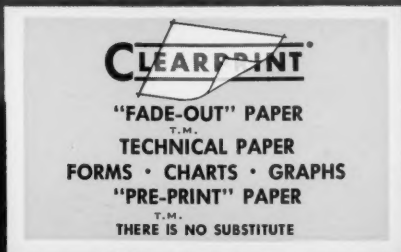
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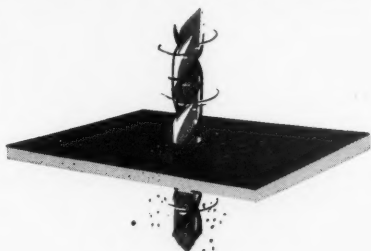
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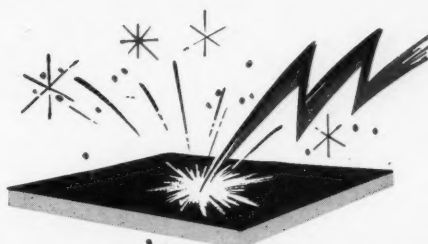
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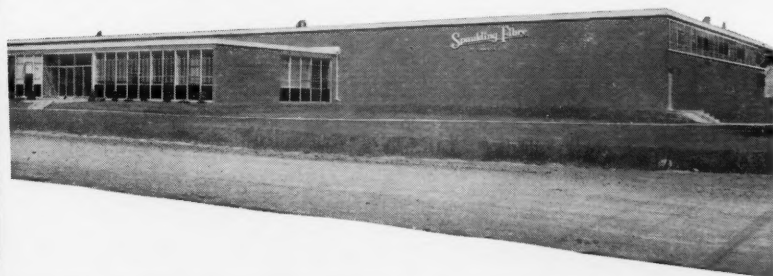
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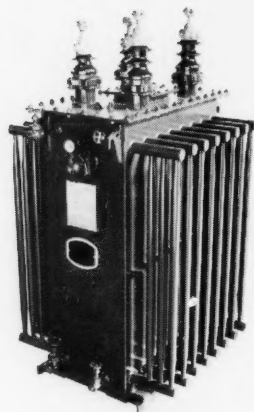
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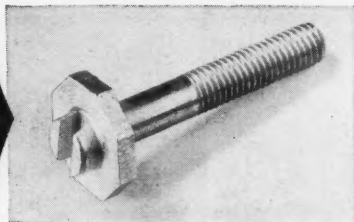
Two (or more) for the price of one!

Here's
PROOF of
savings...



COLD HEADING

Manufacturer 'A'
saves 50% (approx.)
on overall cost

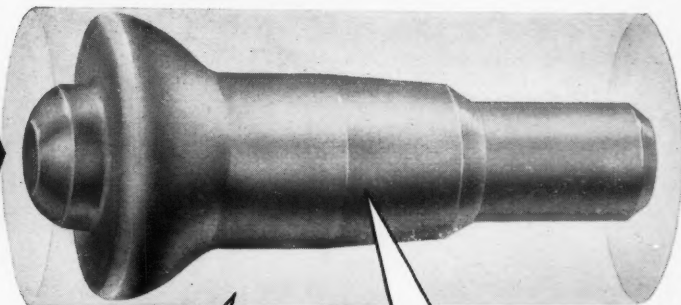


Enlarged view of part previously produced by machining.



Part as now produced by STELCO Cold Heading at half the cost.

Manufacturer 'B'
uses 63.5%
less material



Material blank previously used for machining (actual length 2 1/4") .550 lbs.

Finished part, cold headed by STELCO. Material used .200 lbs.

Any part that can be machined from rod stock is potentially suited to production by cold heading. This technique offers speed of production* without scrap loss — and therefore low unit costs. Costs remain attractively low even when one or more secondary operations is required. In addition, cold working increases the tensile strength of the metal, and produces an excellent surface finish.

Quality of cold headed products is high, be-

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Stelco's Engineers can tell you quickly whether your fasteners or contoured parts can be made by cold heading. If so, the savings are likely to be considerable. Send in your specifications with a drawing and an idea of the application, and you will receive prompt attention.

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DESIGN ENGINEERING SEPTEMBER 1958

**In one recent instance speed of production was increased from 30 per hour to 6000 per hour by converting from automatic screw machine production to cold heading.*

**Forethought
costs less than
Afterthought**

so . . .

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If you need mechanical or electrical counters in any of your new products, here's a word to the cost-wise designer: *Design them in, when you begin . . . don't tack them on later.*

For if you'll give us a chance to work with you, right from the beginning, chances are we can save you time and money by adapting or modifying a *standard* Veeder-Root Counter to your needs . . . where you might get into a costly special job if you went about it alone. What's more, you save time in your engineering, purchasing and assembly departments.

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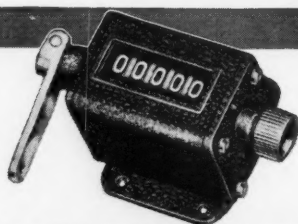


Series 1370 High Speed Counter (1500 to 2500 rpm) built into a wide variety of equipment.

**Everyone...
Can Count on**



Series
1205 Reset
Magnetic Counter with panel
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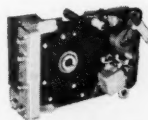
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Miniature Tape Recorder fits in briefcase . . . operates on hearing-aid batteries yielding $1/8000$ h.p. This is possible because friction is reduced by two MPB bearings installed on the main drive shaft. Another man-miracle in the world of miniaturization.



Man With Miracles. This is Bill Timmerman, one of MPB's Sales Engineers. He helped the tape recorder people find exactly the right type of bearing to reduce friction to a minimum, give failure-proof service and help keep original and maintenance costs low.

More Miracles in Miniaturization to come

BEARING ACTUAL SIZE

It's just starting. Industry is on the threshold of new miracles in the world of miniature mechanisms. Best help in the problems will be MPB who has the world's greatest wealth of experience in the application of miniature bearings $\frac{3}{8}$ " O.D. or less. MPB has more than 500 types and

sizes — specials on request — engineering and research facilities second to none. For engineering aid or new catalog write **Miniature Precision Bearings, Inc.**, 709 Precision Park, Keene, N. H. In Canada: Lyman Tube & Bearings, Ltd., Montreal, Toronto, Hamilton, London and Winnipeg.





KEY TO YOUR BEST OPPORTUNITIES IN METALS...

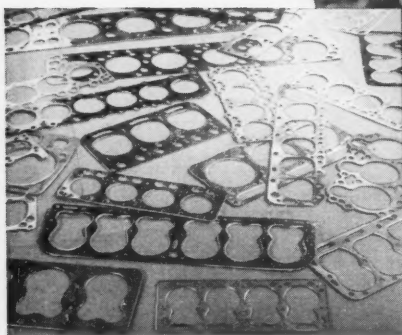
NORANDA COPPER AND BRASS LIMITED

COPPER ALLOY BULLETIN



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Export Department, 1255 Laird Blvd., Town of Mount Royal, P. Q., Canada

Noranda Copper Helps Give Victor Gaskets The "Seal of Approval"



Victor gaskets are made in hundreds of types and sizes.

Victor Mfg. & Gasket Co. of Canada Limited, St. Thomas, Ontario, manufactures all types of gaskets and sealing products, including the heavy-duty automotive and industrial cylinder head gaskets and grommets illustrated.

A Copper Sandwich

The gaskets are made by "sandwiching" a preformed asbestos interliner between two blanked and stamped pieces of Noranda copper strip. Grommets which are used in coolant, oil push rod and other gasket openings are also stamped and formed. These are inserted and closed with specially designed semi-automatic closing equipment.

Rigid Material Specifications

Because of the high-speed blanking and forming operations—and because

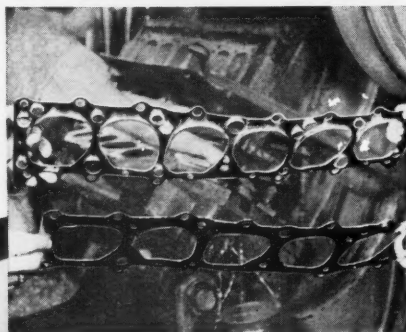


Grommets, which are inserted in gasket openings

the finished gaskets must provide positive sealing under extremes of heat, pressure, vibration and corrosive gases and fluids, the Noranda copper strip must meet rigid specifications. Gauge tolerances are highly important and the copper must be furnished in the proper temper to insure sufficient pliability to permit rapid, accurate working and perfect sealing in use.

Noranda Quality

The consistent uniformity, quality and popular prices of Noranda copper and brass strip, rod and tube have made Noranda a prime source of supply for metals. Join the many metalworking manufacturers who have benefited from Noranda quality and service. Call your nearest Noranda Sales Office today.



Blanked and formed sections of a typical head gasket.

Noranda Aluminum Silicon Bronze 707

by
P. L. CARTER

Technical Service
Manager

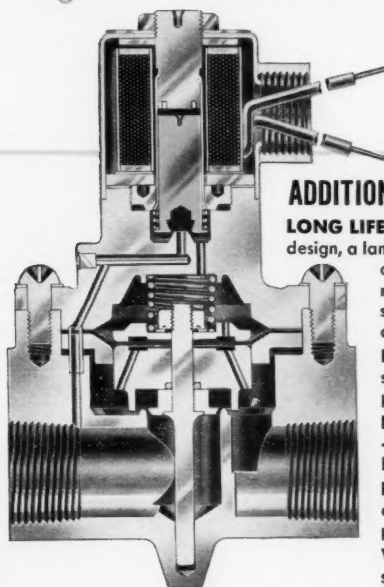
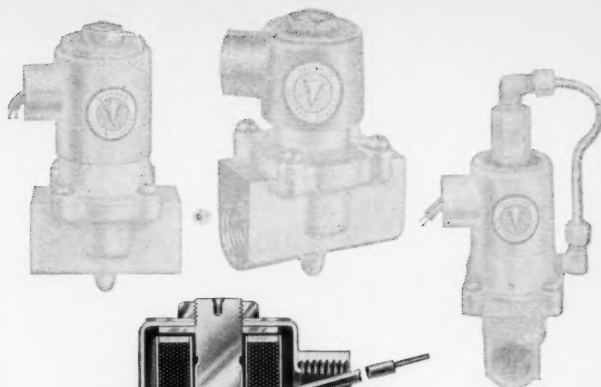
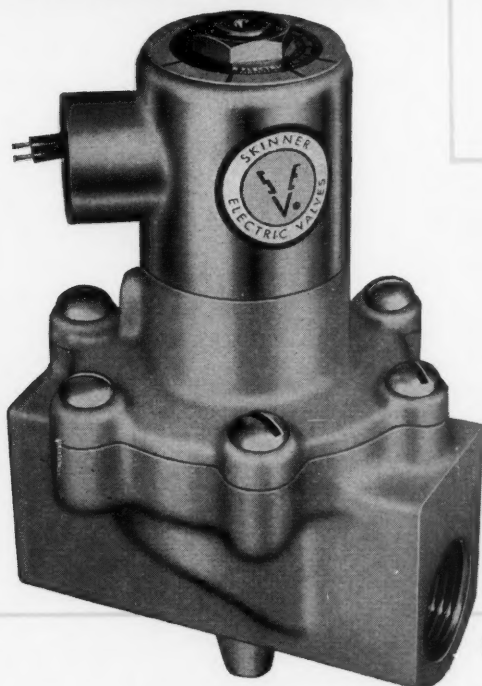


Noranda Aluminum Silicon Bronze, with an average tensile strength of approximately 90,000 psi in the annealed condition, is the ideal alloy for manufacturing valve components, pump parts for high-pressure hydraulic systems, rollers, gears and a variety of parts requiring strength, fatigue resistance and excellent resistance to wear and corrosion.

Available in extruded sections as well as standard rod shapes, Aluminum Silicon Bronze is suitable for light machining and drilling operations (rating 60%) and hot forges readily at temperatures of 1650°—1750° F. Hot forgings made with this alloy are considerably stronger than cold forgings made from most copper-base alloys. Furthermore, such forgings are usually free of dangerous mechanical stresses. Another factor is its high strength-to-weight ratio. For example, it is 9% lighter but 50% stronger than annealed Naval Brass.

In addition to the advantages we have discussed, remember that Noranda's Technical Service Department is always ready to assist you in selecting the alloy or metal best suited to your manufacturing needs. Our aim is to assist you wherever possible to attain quality and economy in your production.

**New low-cost, high-flow,
2-way valves with ...
DEPENDABLE
SKINNER QUALITY**



ADDITIONAL FEATURES

LONG LIFE—unique diaphragm design, a laminate of nylon fabric coated with Buna N rubber, completely supported in open and closed positions.

NO RUSTING—stainless steel internal parts.

RUGGED DESIGN—forged naval brass body.

EASY TO MOUNT—direct to line in any position.

WILL NOT LEAK—soft, synthetic inserts.

L SERIES

These L Series valves with $\frac{3}{4}$ " and 1" diameter orifices complete an *all new* line of 2-way valves previously introduced in January in the $\frac{3}{8}$ " and $\frac{1}{2}$ " sizes.

Manufactured to the highest engineering standards, these pilot-operated, high-flow industrial valves are a welcome addition to the famous Skinner solenoid valve line. They are smaller and more compact than the M2 Series they re-

place and feature a unique diaphragm design. They are also considerably lower in cost. The $\frac{3}{4}$ " size, for example, will cost you 51% less. These larger L Series models — $\frac{3}{4}$ " and 1" — will be available in standard and Explosion-proof construction, normally open or normally closed. They operate on a pressure differential of 5 to 150 psi and will control such common media as air, oil and water.

Skinner has a wide selection of solenoid valves for all types of applications. If you have a control problem, please contact the following Skinner distributors or write us at the address below, Dept. 359.

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515 Fourth Avenue, Lachine
Montreal, Quebec
Phone: MEIrose 7-6746

Dycon Limited
21 Carson Street
Toronto, Ontario
Phone: CLifford 9-8276

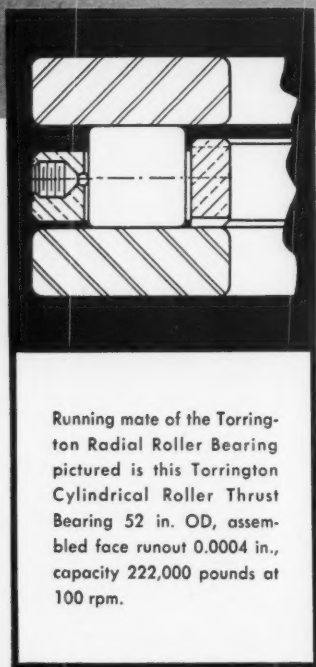
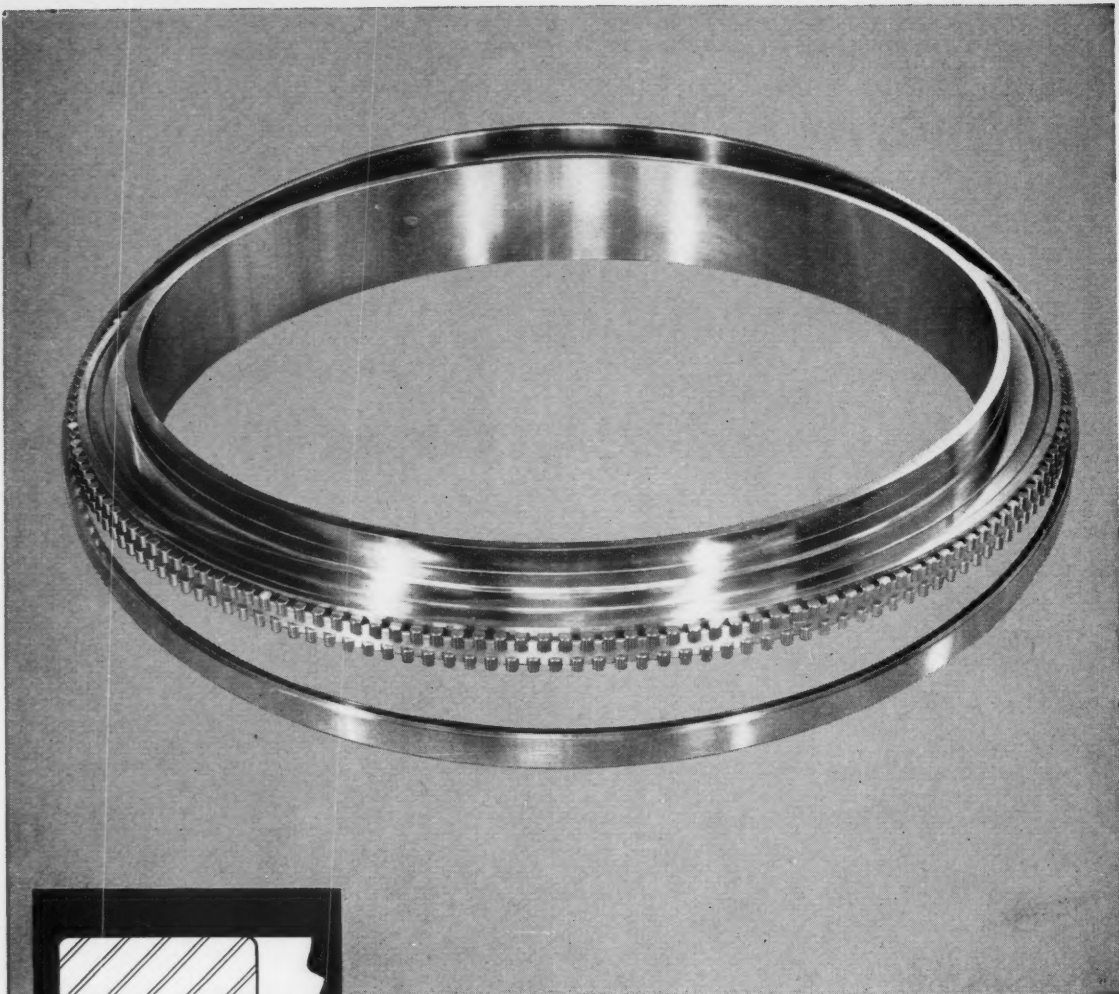
C. M. Lovsted & Co., Ltd.
1726 West 5th Avenue
Vancouver, B. C.
Phone: BAyview 6541

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THE CREST OF QUALITY

**SKINNER ELECTRIC VALVE
DIVISION** NEW BRITAIN
CONNECTICUT
105 EDGEWOOD AVENUE



Running mate of the Torrington Radial Roller Bearing pictured is this Torrington Cylindrical Roller Thrust Bearing 52 in. OD, assembled face runout 0.0004 in., capacity 222,000 pounds at 100 rpm.

A picture of precision... 57.500 inches in diameter!

Here is an ultra-precision Torrington Radial Roller Bearing, custom-built for Wickes Machine Tool Division's 48" Center Drive Profile Lathe.

Almost five feet (57.500 in.) in diameter, it has a total inner race runout of only 0.0005 in. Its 344 rollers are held uniform in diameter within 0.00005 in. Radial capacity is 318,000 lb. at 100 rpm. Rollers are staggered in a one-piece, fully machined bronze cage for precise guidance and cool running. The bearing bore is tapered one inch per foot, and carefully mated to the spindle which was also ground by Torrington.

Such precision is possible only through specialized equipment and highly practiced skills—the same that lie behind the quality of every Torrington bearing, standard or special. Not every bearing order calls for such precision—but each is given the extra measure of care that makes Torrington quality a byword in industry. **The Torrington Company, Limited, 925 Millwood Road, Toronto 17, Ont., Canada.**

TORRINGTON BEARINGS

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HOW THE **SILICONES MAN** HELPED... BUILD THE PATTERN OF A TIRE TREAD

Tire tread designs are patterns with a purpose. Years of research by the tire industry has proven every slot, every angle to be the most efficient . . . to offer the most in road holding with a minimum of wear. This is no small contribution to safer, surer transportation.

Those thousands of thin grooves are difficult to make . . . still, they provide the "biting edge" for safe stops. Molded in standard equipment with extremely thin section molds, the grooves are made possible because of the easy release properties of UNION CARBIDE Silicones. And, production is increased, rejects are reduced. One manufacturer, after eight years of experience, states: "Silicones reduce blemishes on treads, permit complicated

treads not possible without silicones, and eliminates mold cleaning."

This is another example of how the UNION CARBIDE Silicones Man has helped solve an "impossible" problem . . . why UNION CARBIDE is one of the leading suppliers of silicone release agents for the rubber industry.

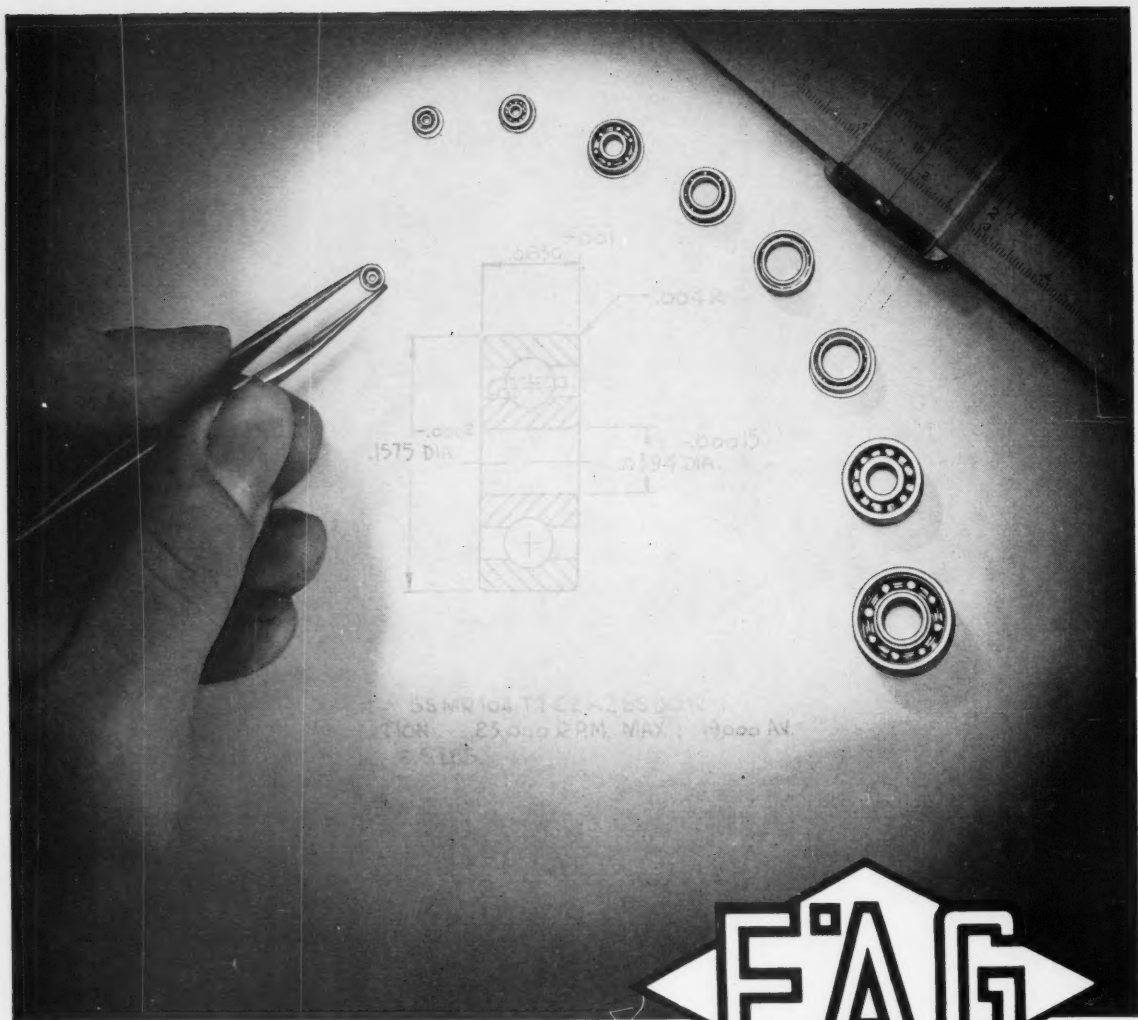
For detailed information on Silicone Rubber Applications

write: **BAKELITE COMPANY**
Div. of Union Carbide Canada Limited
40 St. Clair Ave. E., Toronto 7, Ontario.

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H 7001

News about HYPALON*

Cover of HYPALON
doubles life of elevator
belt exposed to 302° F.

Engineers at a large chemical plant faced a problem of finding an elevator belting material that would resist high temperatures. The belt had to lift hot salt 27 feet from a rotary drying kiln to a loading platform. Heat caused ordinary rubber belts to become brittle, crack and rupture at points where the Monel buckets were attached.

A specially designed belt with a cover of HYPALON synthetic rubber did the trick. It lasted 6 months (the best rubber belts lasted only 3 months) driven 188 feet a minute, hauling hot materials. HYPALON gave this service despite the fact that the belt was totally enclosed and operated 80 hours a week.



Elevator belt has cover of HYPALON. Outlasted previous belts 2 to 1 handling hot salt.

The resistance of HYPALON to heat (250° F.-350° F.) is only one of its many useful properties. It offers outstanding resistance to ozone and strong oxidizing agents; resists abrasion, flex cracking, weather. It can be compounded in a wide range of stable colors. Mail coupon for details on how products made of HYPALON can lower operating costs for you.

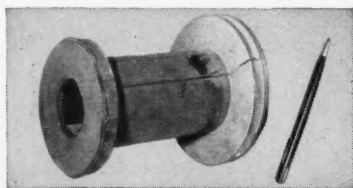
*HYPALON is a registered trademark of E. I. du Pont de Nemours & Co. (Inc.)

Neoprene connectors save \$1000 a year on hydrochloric acid pumps

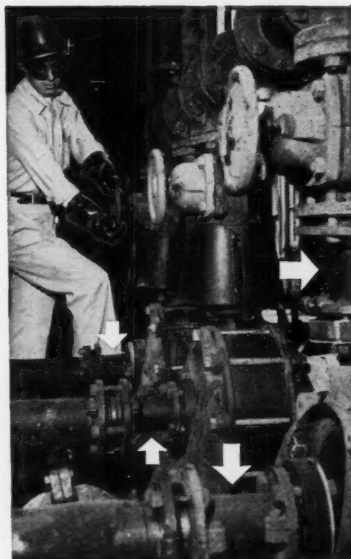
Chemical producer switched
to neoprene when pump vibration
cracked regular fittings

One of the country's largest chemical manufacturers handles great quantities of hydrochloric acid in making end-use products. Pumps are used to distribute acid from the storage tanks to process points. Trouble arose when the fittings connecting pumps to suction and discharge lines cracked under pump vibration. Several rigid non-metallic materials were tried. All withstood the effect of the acid, but failed mechanically under misalignment stress.

Then the company substituted resilient neoprene connectors for the inflexible materials previously used. They worked. Neoprene connectors—resistant to flex fatigue—can compensate for shifting lines... can take distortion without damage. And neoprene connectors are resistant to HCl on the inside, to sunlight and weather on the outside. The change to neoprene saves



Resilient fitting of neoprene takes stress which ruins rigid non-metal types.



Neoprene connectors on acid pumps withstand constant vibration without damage.

this company \$1000 a year in labor and materials.

In tough service such as this, neoprene's *balanced combination* of properties pays off in longer wear, less maintenance. Neoprene resists acids, abrasion, heat, weather, oil and grease. This DuPont synthetic rubber is used in a wide variety of industrial applications where conditions are severe. Hose, belting, gaskets, protective lining, safety clothing are examples. Mail coupon below for details on how neoprene can save you labor and expense.

ELASTOMERS IN ACTION HYPALON® • NEOPRENE

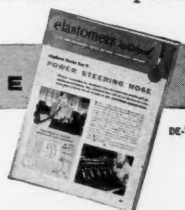


Better Things for Better Living
...through Chemistry

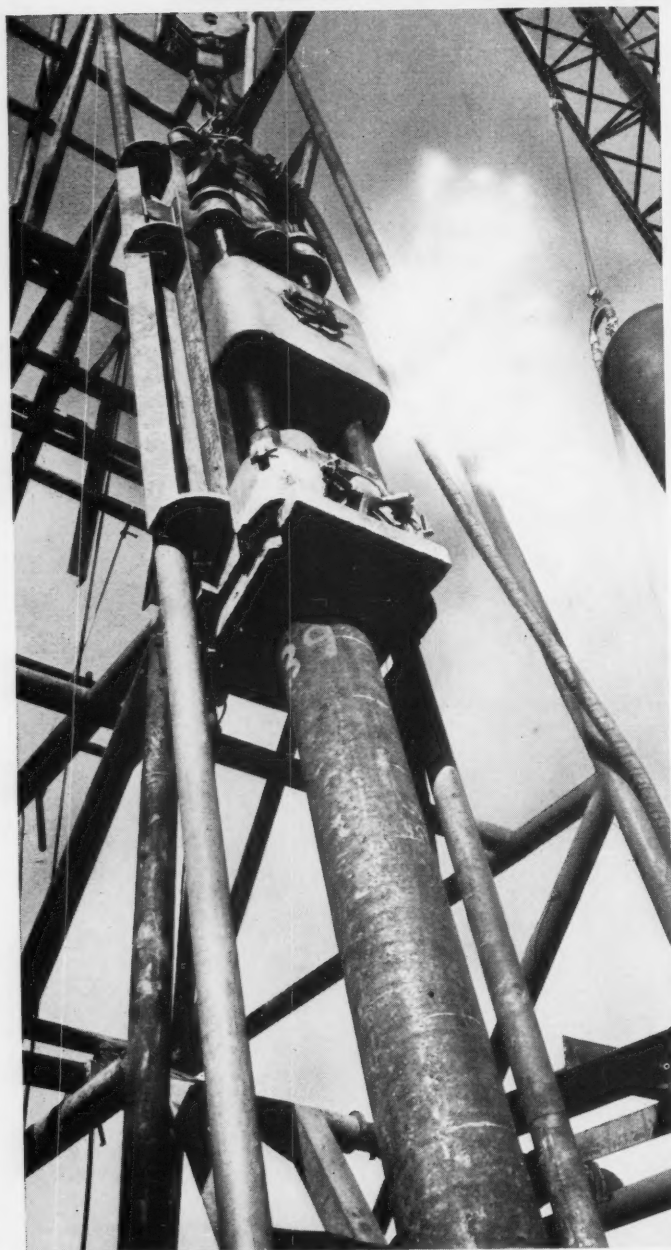
- ☐ I am particularly interested in _____
- ☐ Please add my name to the mailing list for your free publication, the ELASTOMERS NOTEBOOK.

Du Pont Company of Canada (1956) Limited,
Room 400,
85 Eglinton Avenue East,
Toronto, Ontario.

Name _____
Firm _____
Address _____
City _____ Prov. _____



THE NATIONAL SCENE



TOUGH VULCANIZED FIBRE CUSHIONS PILE DRIVER BLOWS to safeguard steel piles against splitting. When a pile driver ram plummets down, its multi-ton wallop can buckle or split unprotected steel piles. Extracting and replacing these piles—or using wood to protect and drive them—wastes time and money. So Savin Construction Corporation, for pile driving operations, constructing bridges for today's super highways, uses a low-cost alternative—a shock-absorbing, built-up disk of tough, resilient National Vulcanized Fibre.

Send for this free 20-page booklet, "Vulcanized Fibre in Industry". It tells the full story of this unique cellulosic plastic—Vulcanized Fibre. Write or 'phone today—no obligation of course. Address Dept. N-9.



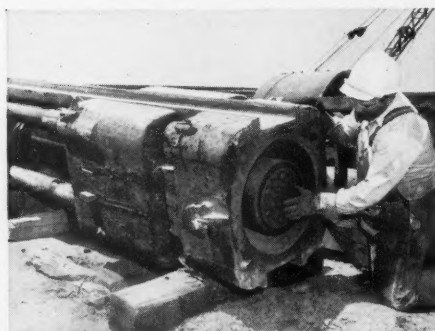
NATIONAL

FIBRE COMPANY OF CANADA, LTD.

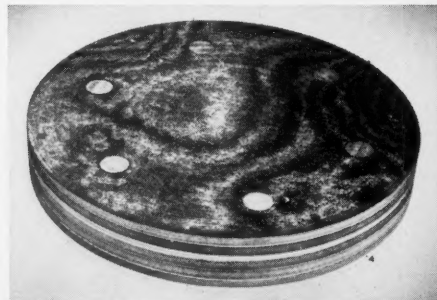
Atlantic & Hanna Aves., Toronto • 1411 Crescent St., Montreal



THIS 14" DIAMETER X 2" THICK DISK TAKES A 10-HOUR BATTERING from the 9-ton hammer before it must be replaced. And because of its small size and light weight, the disk is easily installed in just a few minutes. No delays. No damage to steel piles. Savin, a subsidiary of Merritt, Chapman & Scott, has been using Vulcanized Fibre disks for more than 10 years.



24,500 FOOT-POUNDS PER STROKE is the force exerted by this massive three-and-a-quarter-foot free-fall hammer. Inserted between driving ram and base (from which ears project to position the hammer on the pile) the 14-inch disk takes the full impact of each smashing blow. Here is evidence of the almost unbelievable toughness of Vulcanized Fibre.

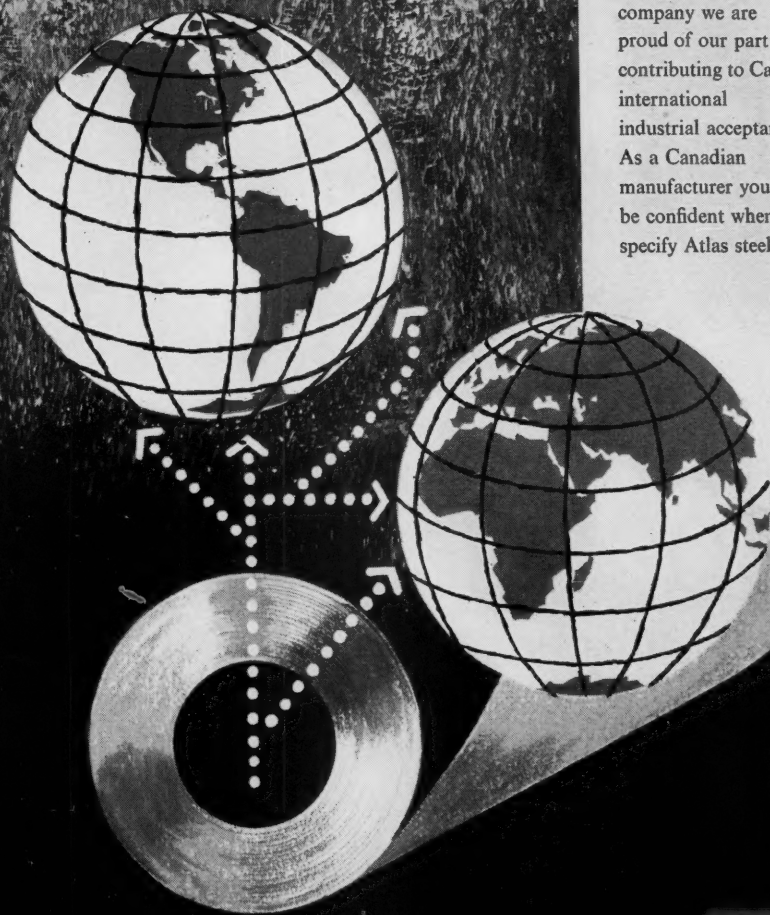


NAME THE PROPERTIES YOU WANT. Typical of the materials tailored to customers' use by National is the pile-driver disk shown here. Virtually any desired combination of properties can be embodied in National's basic engineering materials. For National offers the widest line in the industry—more than 100 grades of Vulcanized Fibre, PHENOLITE® Laminated Plastic and National Nylon. These can be furnished in sheets, tubes and rods—or fabricated special shapes to give you 100% usable parts and components.

DESIGN ENGINEERING SEPTEMBER 1958

ATLAS KNOWS THE WORLD...

and the world recognizes Atlas as a standard of quality in specialty steel — our export orders the world over are proof of this. As a Canadian company we are proud of our part in contributing to Canada's international industrial acceptance. As a Canadian manufacturer you can be confident when you specify Atlas steel.

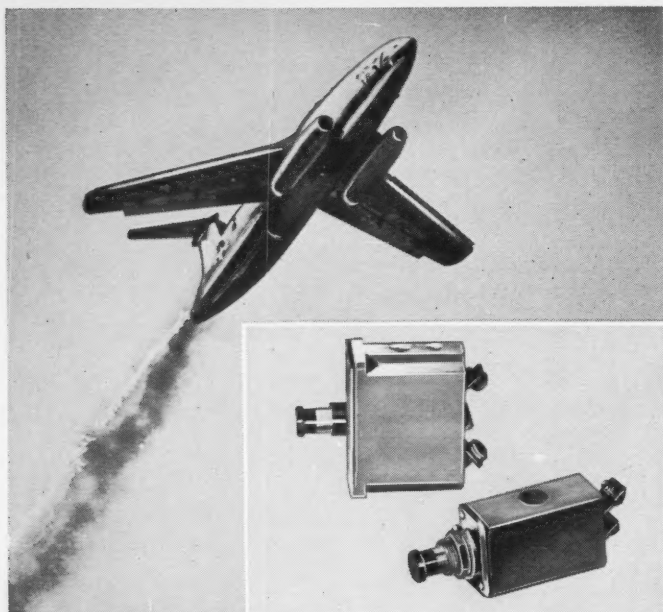


ATLAS STEELS LIMITED Welland, Ontario ■ Warehouses: Montreal, Toronto, Hamilton
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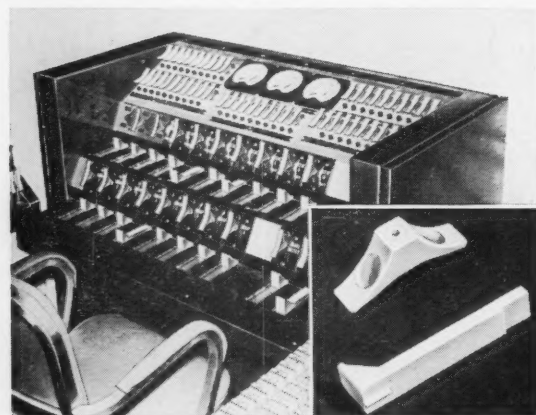
ATLAS STEELS

PLASTICS IN ELECTRICAL DESIGN



An Ounce of Protection

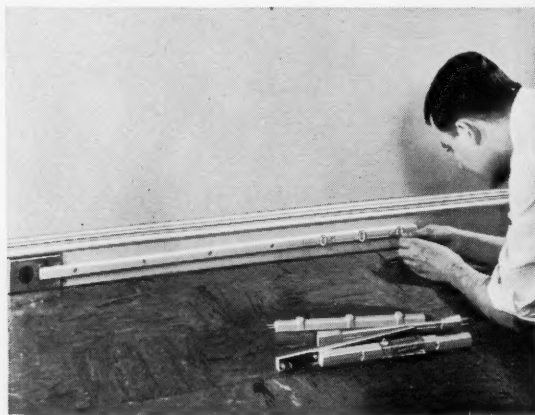
KLIXON precision aircraft circuit breakers have to be light; yet even the smallest, weighing about 1¼ ounces, can safely interrupt a 120-volt ac, 400-cycle circuit delivering over 4000 amperes. To provide the high arc resistance and great physical strength required, Spencer Thermostat Div., Metals and Controls Corp., uses glass-filled CYMEL® melamine plastic housings. These non-corrosive housings are excellent insulators and stand up to impact, humidity, dust, temperature extremes and fire.



Plastic Keys Conduct Orchestra of Light

The Lumitron Lighting Control System permits one operator to play infinite variations in stage-lighting effects using handles and slide bars molded of BEETLE® urea plastic. BEETLE, an excellent dielectric, requires no insulation. Molded-in colors are permanent, permit quick circuit identification for console operator. Developed by Metropolitan Electric Manufacturing Company, the Lumitron has an excellent record of dependable performance.

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New Low-Cost Electrical Outlet System

Made of ivory-colored BEETLE urea molding compound, new interlocking foot-long units provide low-cost, easily installed electrical outlet extensions. BEETLE combines good mechanical and dielectric properties for safe, dependable service, meeting ASTM Specifications D705-49, Grade I. Made by Cable Electric Products, Inc., this new Snapit Inter-Link System is fully approved by Underwriters Laboratories, Inc.

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CYANAMID

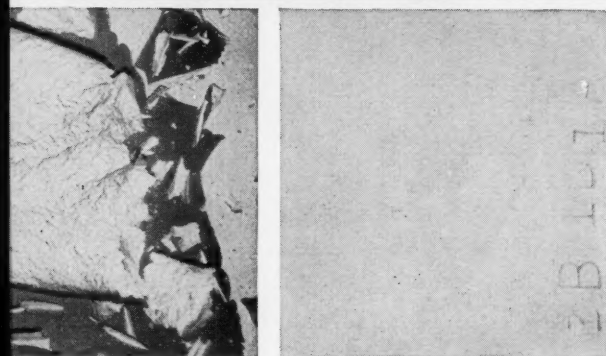
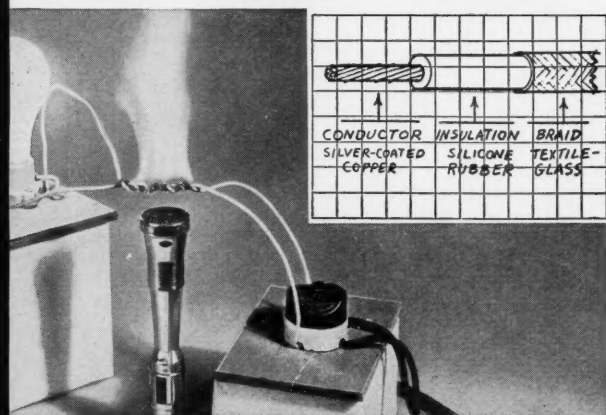
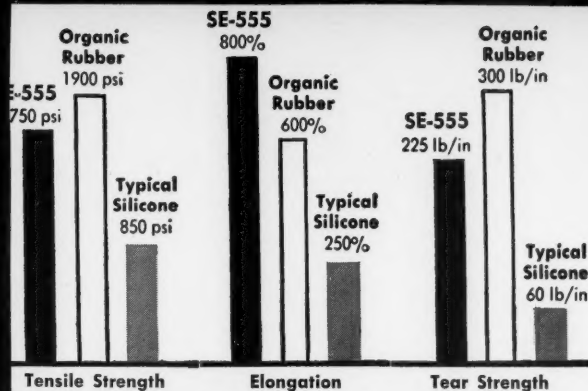
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HOW TO SOLVE PRODUCT DESIGN PROBLEMS WITH



SILICONE IDEAS



Carbon steel coated with an alkyl aluminum finish, subjected to 1000°F for 2 hours.

Carbon steel coated with silicone aluminum finish, subjected to 1000°F for 24 hours.

Problem: Organic rubber parts failing because of temperature extremes and ozone. High tear and tensile strength cannot be sacrificed.

Solution: Replace with SE-555—silicone rubber with tear and tensile strength comparable to organic rubber.

SE-555 is a new silicone rubber with tear and tensile strength double that of ordinary silicone rubber (see comparative typical values at left). Whenever maximum resistance to weather and temperature extremes (minus 150°F to 500°F) is required, combined with high tear and tensile strength, specify SE-555. This is the only material available to rubber fabricators that meets AMS 3345 requirements for tear and tensile strength, elongation, heat resistance, compression set and low temperature flexibility. SE-555 can be fabricated in practically any color, including white.

You can order high strength silicone rubber parts immediately because SE-555 is available from stock for shipment to your fabricator. For more information and a list of qualified fabricators, mail the coupon below.

Problem: Find a wire insulation to withstand extreme conditions of temperature, moisture and ozone.

Solution: Wire insulated with G-E silicone rubber.

Exposed to an 1800°F flame for hours, G-E silicone rubber insulation forms a non-conducting ash which still insulates. No toxic fumes are released, nor will it shrink and expose the conductor, as the laboratory demonstration on the left shows. Silicone rubber has superior dielectric strength at high temperatures and keeps it for years. It has unparalleled ozone resistance, stays flexible down to minus 75°F or lower. Use silicone rubber insulated wire wherever temperatures are extreme, and where an extra safety margin is needed. Examples: aircraft wire, Class B and H motor and apparatus lead wire, electronic hook-up wire and control cable. Want more information? Send in coupon below.

Problem: Extend the life and appearance of metal surfaces designed for high temperature operation.

Solution: Special paints made with G-E silicones.

Silicone based paints are finding increased application as corrosion-resistant or appearance-preservation coatings for many metals exposed to continuous temperatures as high as 1000°F. For instance, special aluminum-silicone paints often make it possible to use mild steel instead of stainless steel in industrial applications. High gloss silicone paints have proved to be amazingly durable finishes for heaters, appliances, etc. Gloss and color are retained up to 440°F, and the finish resists marring, scratching and chemical attack more than ordinary paints. Check into the performance advantages of high temperature silicone paints. Special paint formulations have been developed by leading paint manufacturers for specific temperature ranges and applications. For more data, fill in the coupon below.

HIGH STRENGTH RUBBER PARTS

HIGH TEMPERATURE WIRE INSULATION

HIGH TEMPERATURE PAINTS



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recognized the world over as the outstanding speed reducing units for all industrial drives, are characterised by their **RELIABILITY, HIGH LOAD CARRYING CAPACITY, EFFICIENCY AND COMPACTNESS**

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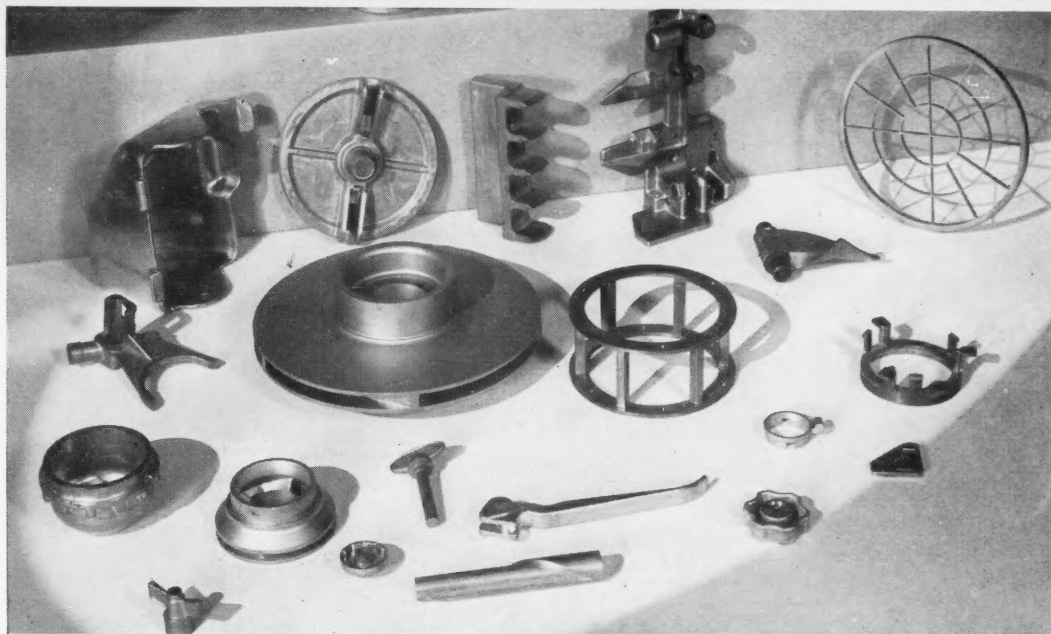
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Design Engineering



Photograph shows several different applications typical of those produced by the vacuum die casting process.

Vacuum die casting saves on machining

Vacuum die casting of aluminum bronze and silicon bronze (as carried out by The Aurora Metal Company) takes the following steps.

A steel die is totally enclosed in an airtight housing. This housing (or "receiver," as it is called) has two openings: one is the sprue opening and the other the vacuum outlet. The sprue opening is submerged in a pot of molten metal and through it the metal enters the die. The vacuum is applied through the vacuum outlet, creating a differential pressure between the die cavity and the atmospheric pressure on the molten metal in the pot. This difference in pressure causes the molten metal to flow into the die and completely fill the cavity. Here it solidifies and faithfully reproduces the contours. The die is then removed from the receiver, opened and the casting ejected.

The dimensional tolerances that can be maintained are naturally of the utmost importance to the user. Often they eliminate expensive machining operations. Although rules on tolerances are not hard and fast, in general a tolerance of $\pm .5\%$ of the linear dimension is maintained. It is cheaper, of course, to maintain a tolerance of $\pm .010$ than it is to maintain $\pm .005$. Tolerances are also affected by die contours and sections. Dimensions entirely within one section of the die are relatively easy to maintain in production, whereas dimensions across a parting line present more of a prob-

lem. Sharp corners may or may not be difficult, depending on how the die can be parted. Straight holes of $\frac{3}{8}$ in. diameter and less may usually be drilled more economically than cast. It is often possible to combine the sprue removal and flash trimming operation with a machining operation. This gives the customer a machined dimension at no additional expense. Inserts may be cast securely in place.

Aluminum bronze and silicon bronze vacuum die castings cannot be compared in price with white-metal die castings or with sand castings or forgings used without extensive machining operations.

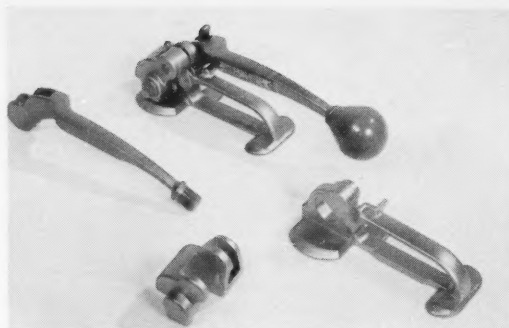
However, when one of the following situations is of prime importance, vacuum die castings show remarkable economies.

1. Where external machine work is being done on a part.
2. Where one or more parts can be combined into a single vacuum die casting.
3. Where strength is of prime importance.
4. Where resistance to corrosion is important.
5. Where heat tends to cut down the strength of other materials.
6. Where high losses are encountered both before and after machining, due to shrinks, voids, gas pockets or porosity.

Typical applications are given on next two pages.

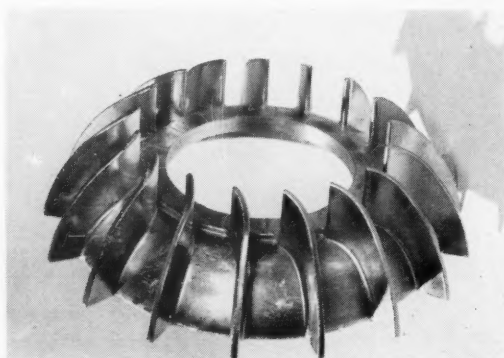
1

Steel strapping tool components. The three castings pictured in the foreground are all vacuum die cast in aluminum bronze alloy, Aur-O-Met 15. Because of the close tolerances that can be achieved in the process, no machining of these components is necessary, except for the drilling operations to pin the pieces together into the unit shown in the background. (The threading shown on the lever has been done away with: the plastic ball-shaped grip is now molded directly onto the bronze.) The high strength and hardness of Aur-O-Met 15 gives long tool life and eliminates the previously required heat-treating operation. This material also has excellent resistance to impact, an important factor, considering the rough usage.



2

Mixed flow fan casting. This part is cast in aluminum alloy Aur-O-Met 11B. It is used to cool generators, many of which are used on military aircraft and tanks, and similar critical units. The part operates at about 8,000 rpm and has been tested up to 17,000 rpm without failure. The smooth die cast surfaces achieved by vacuum die casting are, of course, important for maximum air flow. The close tolerances achieved, too, are a factor for equalized air flow and reduction in balancing time.

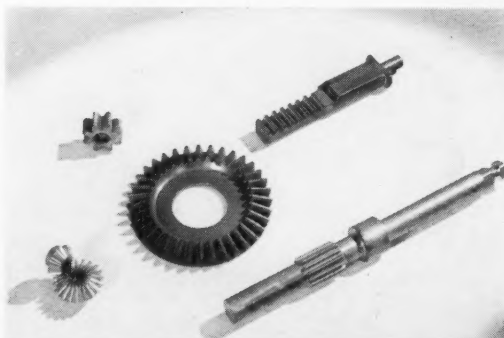


3

This photograph illustrates some typical "as cast" tooth forms produced by vacuum die casting. The small bevel gear and pinion in the lower left-hand corner are cast in Aur-O-Met 11B, and are used as drive gears in a low-hp outboard motor.

The spur gear in the upper left hand corner is for a lock mechanism. It is cast in Aur-O-Met 11B. The large bevel gear (in Aur-O-Met 11) is used in a lawn-mower drive mechanism.

The rack and pinion (shown on the right-hand side) are used in locomotive steam shut-off valves. They also are cast in Aur-O-Met 11.



4

This flange, for the pressure refueling of aircraft, is vacuum die cast in Aur-O-Met 11B. It is fastened directly to the underside of the aircraft and functions as a support, seal and connection for the fueling nozzle, when planes are refueled on the ground. Close tolerance casting eliminates all machining, except for the drilling of the small holes and the turning and facing of the seal areas. The high strength of alloy 11B was an important factor, because the three lugs on this flange must support the entire weight of the nozzle assembly. Wear resistance, too, is important, for any wear on these areas would eventually permit leaking as seal clearances were increased.



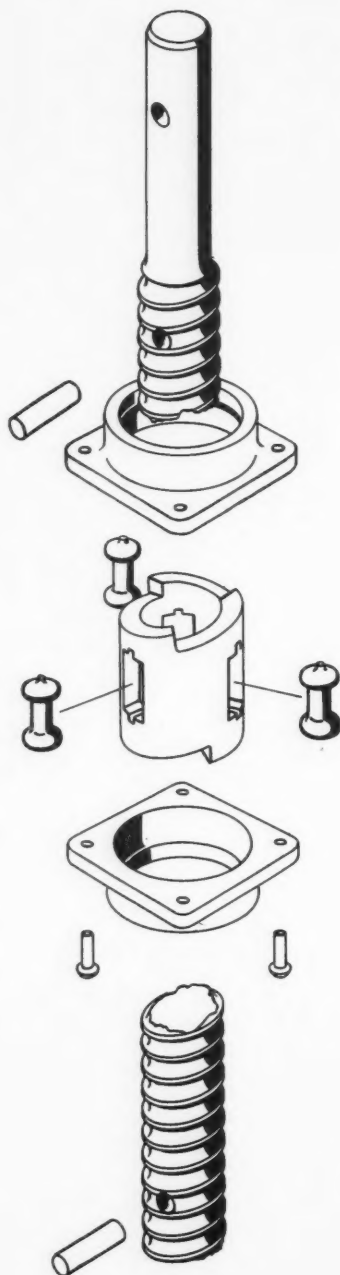
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Pump Impellers. This picture shows a few of the many centrifugal pump impellers produced as vacuum die castings in silicon bronze alloy, Aur-O-Met-145. Because of the close tolerances and smooth surface possible with the process, machining is normally limited to the turning of the seal diameter and the machining of the hub to receive the motor shaft. The internal waterways and vanes are cored by means of a specially developed sand core process, which assures a high degree of accuracy throughout the waterways, and a smooth internal surface. Both these factors tend to increase pump efficiencies and maintain excellent hydraulic balance.



Aur-O-Met alloy number	Alloy type	NOMINAL CHEMICAL COMPOSITION							RANGE OF PHYSICAL PROPERTIES				Common specifications
		Copper	Aluminum	Iron	Nickel	Zinc	Silicon	Others	Tensile psi	Yield strength psi	% elongation	Hardness Rockwell B	
11	Aluminum bronze	89.0	9.8	1.0				.5 max.	73,000 85,000	26,000 38,000	40 25	66 74	ASTM B1 48-42T Grade B QQ-B-671 Grade B as Cast 46-B-18C SAE. 68B
11 Heat Treated	Aluminum bronze	89.0	9.8	1.0				.5 max.	78,000 100,000	45,000 60,000	14 3	87 93	Heat treated form of Alloy 11
11B	Aluminum bronze	88.5	10.5	1.0				.5 max.	80,000 90,000	35,000 45,000	25 20	75 81	Special form of alloy 11
15	Aluminum bronze	86.7	11.3	2.0				.5 max.	80,000 100,000	40,000 60,000	12 3	88 95	QQ-B-671b-1
56	Nickel aluminum bronze	80.5	10.5	4.25	4.75			.5 max.	90,000 100,000	50,000 60,000	10 5	89 93	ASTM B-148-42T Grade 9A-2 SAE. 68A QQ-B-671 Grade A (as cast) Grade C (Heat treat) Grade D (Heat treat) AN-QQ-B-672 Equivalent to AMS 4640
57	High nickel aluminum bronze	76.0	12.0	5.0	7.0			.5 max.	105,000 120,000	80,000 85,000	5 0	100 110	Special hard bronze requirement
145	Silicon bronze	81.5				14	5	.3 max.	70,000 92,000	40,000 60,000	20 15	75 85	ASTM B-198-48-13B

Antifriction screw with dumb-bells



Exploded diagram

An antifriction screw (called the Roton bearing) has been developed by The Anderson Company. Designed into nut and screw assemblies, the bearing allows efficient conversion of rotary to linear movement (or vice versa) over a wide range of work loads and power inputs.

The assembly presents novel design features including the dumb-bell shaped antifriction units. These units are caged and roll within annularly grooved nut (functioning as the outer race) with the helical thread lead of the screw acting as the inner race.

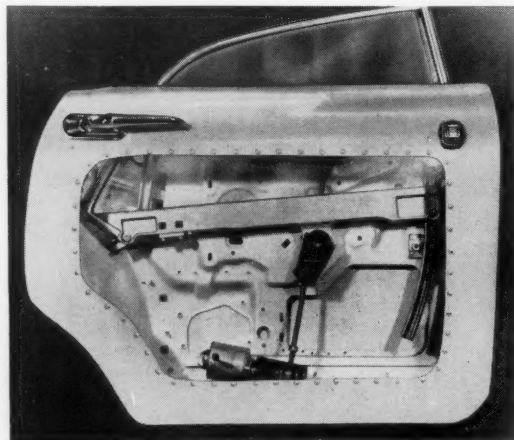
The nut itself is made in one or more parts; the number of Roton units used is sufficient to meet the load requirements.

Planetary action of the caged units results in a mechanical reduction of linear advancement relative to the thread lead, thereby supplementing speed reducers and gear boxes, or eliminating them when the ratio permits.

Another important advantage of the assembly is its ability to provide for "freewheeling" at a predetermined end of travel pending reversal of motion.

These antifriction units do not jam: they work effectively under conditions that can cause freezing of other forms of antifriction nut.

This antifriction bearing screw has all the inherent advantages of an antifriction power actuator as well as economy in space, weight and cost, plus ease of installation and reliable performance. ★



Application of the Roton bearing to powered windows.



Densified wood shuttles have good wear and impact resistance and a surface that won't harm delicate fibres.

Plastic laminates — strong and light

W. S. Berry BAKELITE CO.

Laminated plastics are produced by applying heat and pressure to layers of paper, fabric and other base materials that have been impregnated with heat-reactive, thermosetting resin solutions. The laminates are made in sheets, tubes, rods and molded shapes in various grades, finishes and dimensions.

The types and grades of laminated plastic vary in the pressures used in their processing, in the particular kind and amount of phenolic resin, and in the kind of laminating material used as base. A variety of grades

of laminated material is available, featuring as base material paper, cotton fabric, asbestos, glass cloth and nylon fabric.

The base material is impregnated with phenolic resin on specialized equipment. The sheet passes continuously through a dip tank so that the resin is applied uniformly. The resin-treated sheet then passes a drier, where the solvent is evaporated. Here the resin is converted to an intermediate stage, to permit handling. The processed web is then either rolled into tubes or rods or cut into sheets.

To produce sheet stock, impregnated sheets are

Industrial laminated plastics (made with thermosetting resins) are important electrical insulating and structural materials. Often, they can provide distinctive styling and production economy.

Designers have made good use of the properties of laminates for many mechanical and structural uses in the electrical, automotive, aircraft and chemical processing fields. Laminated plastics are essential components of telephone equipment, radio and TV parts, washers and punched parts for electrical insulation, automotive ignition systems, silent gears, textile bobbins and airplane parts.

Only half the weight of aluminum, yet strong and tough, laminated plastics offer the design engineer many interesting possibilities. This versatility is aided because they are supplied in a variety of forms. For example, their availability as sheet allows the manufacture of punched laminated parts, which are cheaper than moldings. It also permits parts to be made for short production runs that would not justify the expense of molding dies.

Design engineers who can use a useful tabulated list of properties should ring Readers Service Card 209 for brochure, "Bakelite plastic laminates."

placed between heavy stainless steel plates. These are then subjected to carefully controlled heat and pressure. When taken from the press, the individual laminations have become fused to a hard homogeneous sheet.

Tubes are formed by rolling impregnated sheets on mandrels between heated pressure rolls, and subsequent curing in an oven or molding under pressure in a hydraulic press. After a further cure-cycle, the mandrel is removed from the tube, and the outside diameter of the tube ground or sanded to the desired size.

Molded laminated plastics bridge the gap between molded plastic products and laminated plastics. This development enables the molding of simple shapes from resin impregnated fillers. The resulting products have the mechanical strength of laminated plastics and yet have the advantages of being molded to form.

Properties. Laminated plastics are heat-resistant; have a high strength-to-weight ratio; high dielectric strength, good resistance to corrosion, immunity to water, brine, oil, ordinary solvents, most acids and weak alkalis; excellent dimensional stability; a low coefficient of friction; and low thermal conductivity.

Laminates are easy to fabricate, for they can be machined with standard metal-working tools. For some operations, high-speed woodworking machines (circular and band saws, spindle shapers and sanders) may be used to advantage.

Bakelite produces a range of finished laminated sheet, tube and rod stocks for those who have complete machining facilities to produce a finished part.

Their plant also has modern fabricating facilities for finishing laminated parts to a customer's specification.

The lightness and low shear strength of laminates permits high cutting speeds and feeds with much less tool pressure than is required for metals. Rapid and accurate fabricating is possible at surface speeds as high as 1,500 fpm for drilling, 4,000 fpm for boring and turning, and 13,000 fpm for sawing. Because of the resiliency of plastic laminates, all cutting tools must be kept extremely sharp, for accuracy and fine finish.

In designing products to be made of molded-laminated materials, interior walls, webs, recesses and cavities should have a taper of not less than one degree.

Because of the low heat transmission of the material, it is necessary to compensate for its natural insulating

properties when performing at high speed, confined machining operations.

Where design will permit, all drilling, tapping and broaching should be done at right angles to the laminations. The laminated structure of the material also requires care when milling at right angles to the laminations, as in the milling of gear teeth.

Laminates can be sheared with a standard metal square shear of the guillotine type, or a rotary shearer. Thicknesses up to 1/16 in. can be sheared cold. Sheets 1/10 to 3/8 in. thick should be heated to approximately 280 F. With standard woodworking band saws, any thickness up to 10 in. can be sawed at speeds up to 8,000 fpm.

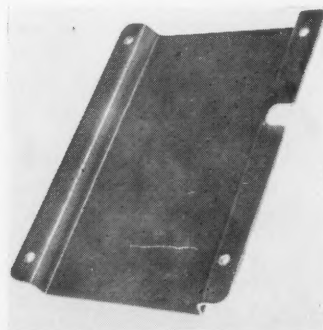
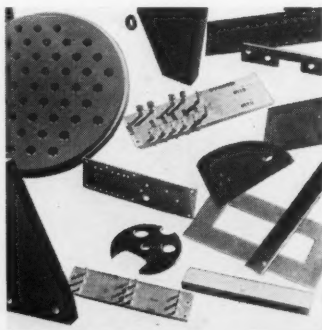
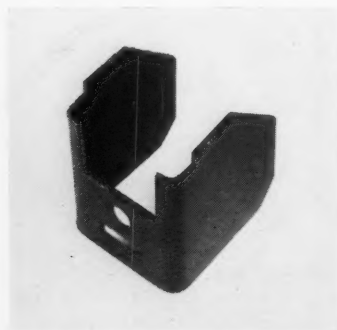
Laminates can be punched, shaved and broached, depending on the thickness and grade of material. Punching produces a relatively smooth edge in thicknesses up to 1/16 in. For extra smoothness (especially in thicknesses over 1/16 in.) shaving should be specified. Resilience and heat insulation of the laminates have noticeable effect in drill press operations. Drills have been designed especially for this material.

Laminates can be successfully threaded on standard equipment, using high speed steel taps, dies or single point chasers. Laminates can be engraved, stamped or printed.

Applications. In general, designers specify paper-base laminates where electrical properties (rather than high mechanical strength) are the chief requirements. Fillers of cotton fabric are used wherever mechanical strength is called for. Asbestos-base materials are used where greater heat resistance, low water absorption and dimensional stability are desired. For maximum shock resistance, canvas-base laminated plastics are generally employed. Glass cloth base laminates possess excellent heat resistance and mechanical properties, particularly impact strength. This type is also outstanding in its electrical properties.

The following applications of laminated plastics may help the design engineer visualize other possibilities for the material.

Sheet stock is widely used. For example, gears are made usually from sheet stock with a canvas base. This results in high tensile and impact strength and extreme durability. These gears are well suited to severe service conditions where life is important. Gears made from this stock run with little wear on the gear teeth and are quiet in service. Since these laminates are only half the weight of aluminum (and a sixth that of steel)



their low inertia makes laminated gears easy to start and stop. This is important in high speed machines with frequently interrupted operations. In addition, gears made from this stock can run in oil without softening or absorbing the oil. They take up very little moisture and hold their dimensions.

Such gears have many applications: as heavy-duty gears for mine hoists and power shovels; average duty gears for lathes, screw machines, automobile timing gears, washing and ironing machines and other precision and heavy-duty machinery.

For some small-face gears, a finely woven cloth fabric base laminate is preferred. This results in a dense, uniform structure highly suitable when cut into small gears for electric clocks, speedometers, record players, washing machine and electric motors.

Laminated plastic pinion gears have been used on coal conveyors. Their life is greater than that of the steel gears previously used, because of their greater resistance to abrasion.

One interesting and widely used application for plastic laminates in Canada is in the manufacture of 4 ft diameter gears for paper machine drives. In this application, the laminate is bolted to a metal spider. In addition to the longer life, other advantages over metal gears are the resulting silent drive and greater resiliency; and thus the reduced vibration and noise.

A growing use for sheet stock is in printed circuits for the electronics industry. At Bakelite's plant, sheets of copper are bonded to the laminated plastic material. The electronics industry uses this copper laminated stock to imprint electrical circuits with acid-resistant ink. This new development is widely used to make radio and television sets and in proximity fuses.

The uses of tubing are varied and include: electrical coil forms, high speed ball-bearing retainers and ball bearings, gas meter pipe nipples and couplings, brush holder bushings and essential components for relays, controllers, automatic power switches and other heavy-duty electrical apparatus. Laminated plastic bearings are widely used in Canada in steel roll mills, and in pulp mill beaters. Their advantage in beaters is that they are lubricated with water instead of grease. Apart from economy, there is no danger of grease leaking into the pulp stock. The life of laminated bearings in pulp beaters is four times that of conventional bearings.

Molded laminated plastics are also available. A few of the items made by this method include casters, gear blanks, wheels, covers of various types, heavy-duty bearings and other industrial equipment.

Densified wood is a specialized form of laminated plastic. This new product of the Belleville plant is a laminated material made from an assembly of resin-impregnated wood veneers, highly compressed at the time of setting the resin.

Depending upon the pressure, the original thickness of the veneer assembly will decrease during compression by as much as 50%.

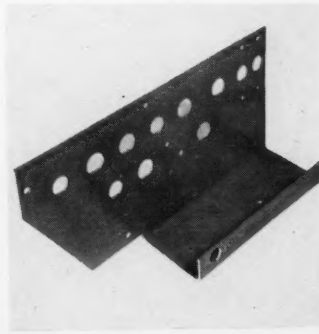
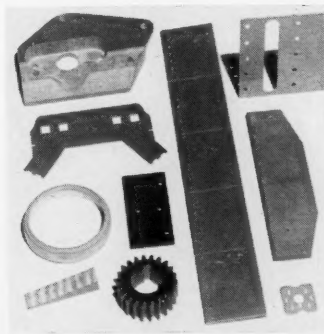
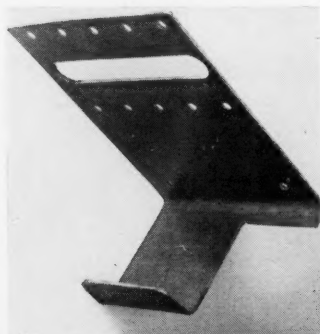
The resulting densified wood is harder than any wood, is half the weight of aluminum and has exceptional wearing qualities. Resistant to water, abrasion and chemicals, the material also has excellent electrical and mechanical properties.

Its properties can be "tailor-made" to meet the designer's requirements for high density, tensile strength and electrical properties. As an engineering material that presents the maximum in decorative possibilities, strength and durability, densified wood offers great variety to the designer. Because of its exceptional long-wearing qualities, the material is especially valuable in reducing maintenance costs and maintaining quality production.

These are typical properties for one of the grades available, Bakelite Grade W-1. This is a birch veneer densified wood with the grain of alternate veneers at right angles.

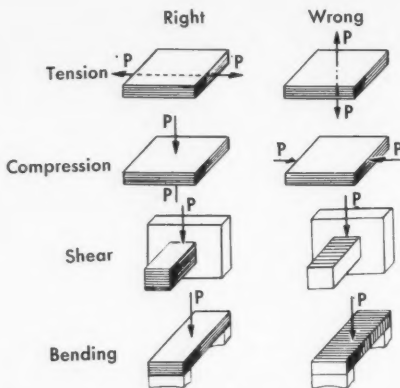
Tensile strength	20,000 psi
Flexural strength	30,000 psi
Modulus of elasticity	2.3×10^6 psi
Impact strength	3.0 ft lb/in. notch
Compressive strength	40,000 psi
Bond strength	1,200 lb
Specific gravity	1.3
Specific volume	21.4 cu in./lb
Water absorption	1.5%
Dielectric strength	
parallel to laminations	60 kv
Dielectric strength	
perpendicular to laminations	400 v/mil.
Dissipation factor at 1 mc	.06%
Dielectric constant at 1 mc	10

The material can be buffed to a high polish, and machining will not destroy its beautiful appearance. The range of applications are broad and varied and include: Bobbins and shuttles for textile equipment, switchgear, transformer parts, aircraft propellers, silent gears, metal working dies, jigs, patterns and bearings. ★

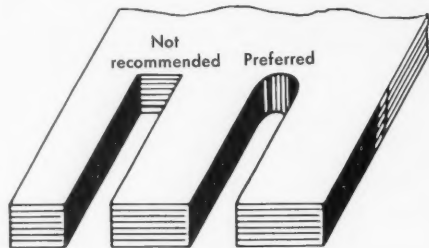


Design hints for laminated plastics

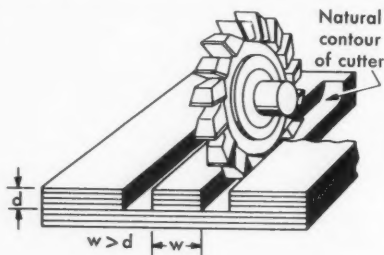
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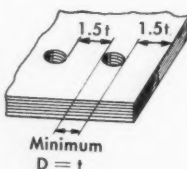
Direction of loading in relation to laminations is important. Designs in which loads tend to separate or buckle laminations should be avoided.



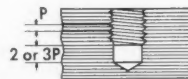
Slot ends should be designed with rounded or radial end rather than square whenever possible. This permits use of end milling cutters to avoid added cost of filing and other finishing.



Width of milled slots should be greater than depth, otherwise ridge between slots is liable to split or break off entirely. Also, milled slots should not be stopped with square corners. Allow bottom of slot to emerge to surface with natural contour of cutter.



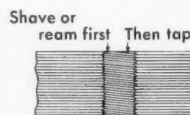
Punched holes should always be located with at least $1.5t$ between hole and edge of material. Hole diameter should never be less than thickness of sheet; punch breakage is liable to occur for smaller diameters.



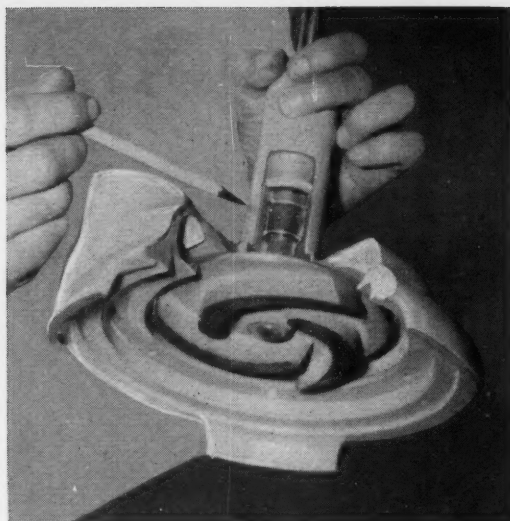
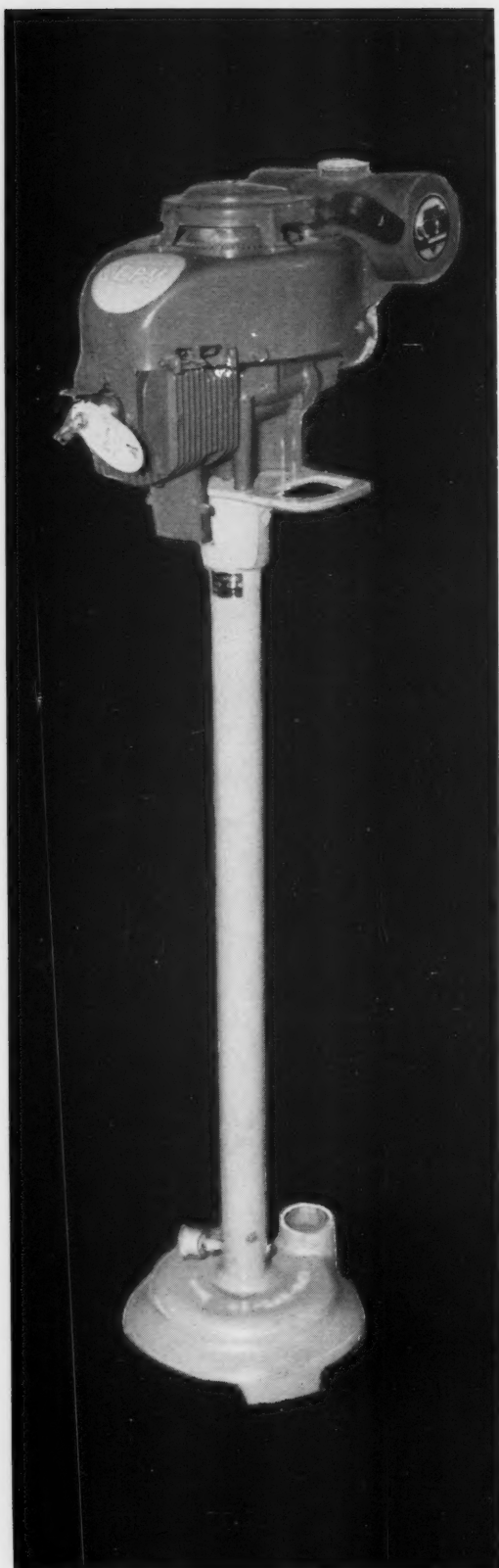
Tapped, blind holes require a clearance of two or three times thread pitch at bottom of hole, otherwise threads will be stripped or slight delamination will occur.



Irregularly shaped holes should be avoided unless the piece is thin enough to allow the holes to be punched. Special tools or additional operations are necessary for irregular holes in thick material.



Tapped holes should be shaved or reamed before tapping otherwise edge of threads will be rough and a screw insert may not fit properly. Tapping should not be specified closer than a class 2 fit with 65 per cent to 70 per cent thread.



Portable pump

A Canadian answer to mud and sand

Mud and sand present no problem to a new lightweight portable sump pump now being turned out in the manufacturing plant of its Winnipeg designer, David Martens.

The pump weighs 41 lb, stands 44 in. high, and is powered by a 2 hp, two-cycle Clinton gas engine. It is said to be the only engine-driven field pump on the market.

There is no suction hose; the base of the pump is dropped square in the sump where water lies, and the pump held steady (and in place) by suction.

Performance ranges from 5,000 gph at a 5 ft head to 1,020 gph at a 70 ft head.

An electrician by trade, Martens became interested in pumping problems on construction jobs where mud and heavy slush in new basements impeded workers.

Available pumps (mostly in the 160 lb class) used suction hoses and were often stymied by mud and sand. Martens saw the need for a light, portable pump that could easily be shifted about on the roughest chores.

The base and stand of the pump are pre-cast from high-grade grey cast-iron and the $\frac{3}{8}$ in. shaft is of stainless steel. Between the shaft and impeller and the bottom of the base there is a wire-plate cover; then below this, a screen to protect the working parts.

The pump, though not affected by dirty or muddy water, is given further protection against damage to bearings by grease seals. An oilite bushing is set on the shaft below the bearing and just above the impeller.

There is only one grease cup and instructions with the pump advise the operator to keep it filled.

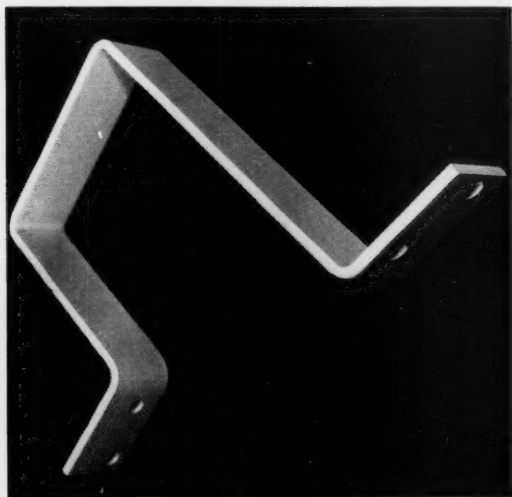
The motor (a Clinton gas engine or an electric motor) can be quickly fastened to the top of the stand by four bolts. Handles on each side make it easy to carry about.

Generally, the pump finds ready use on farms (particularly for irrigation) and in construction work. But it has other uses, such as for a water-pumping system.



The new developments in torsion bars

While the words "torsion bar" probably conjure up the mental picture of a round bar with upset forged ends, the number of variations in this type of spring is just as many as with any other type of spring. One of the variations on which The Mather Spring Company has done development work was discussed in an SAE lecture by R. E. Hanslip and L. O. Imber.



At left is a U-shaped spring. It does not look like a torsion spring, but it is. As far as is known, this is the first torsion spring designed to operate off the pivot line about which two bodies have relative angular motion. Such a spring requires the torque in each leg to be equal, so that the inactive portion connecting them will assume the role of a constant-moment beam. The angular movement of the two bodies connected by this spring must be such that the distance between the anchor points on the two bodies does not change considerably with respect to the length of the inactive part of the spring. This requirement precludes the introduction of bending stresses, except those of insignificant magnitude, compared with the shear stresses. Attention is called to the fact that a flat bar, carrying a torsional load, has been bent at nearly a right angle, thus forming a very simple anchor for a plate-type torsion bar.

Heading the page is an installation of this spring. As can be seen, the two legs are of different lengths. The longer leg is connected to the frame (of an automobile) and the shorter leg to the trailing arm of the rear suspension. The U-spring serves as an auxiliary to an air spring. It will also be noticed that, in addition to being of unequal length, the legs are positioned at different distances with respect to the pivot point of the trailing arm. These distances are in inverse ratio with respect to the lengths of the adjacent legs for, if the torque in each leg is to be equal, the longer leg must twist more than the shorter leg. ★

Hand controls designed to match a job

Douglas R. Witt IMAGINATION UNLIMITED

The proper selection of hand controls for any product is a step toward efficiency in the operation of the product. This article is a picture guide for the design engineer to help him in the correct hand control design.

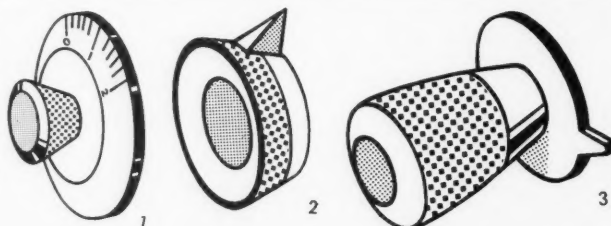
Before designing a hand control, the engineer must take two factors into consideration: the human hand and the type of control required. No matter whether it is a button, knob or lever, it must be grasped and pushed, pulled or turned. If it is easy for the hand to carry out the control function, the chances of operator error are naturally reduced and the user is more likely to have a favorable impression of the product. The size and shape of the control is determined by the hand, if it is to do a satisfactory job.

Four steps enter into the design:

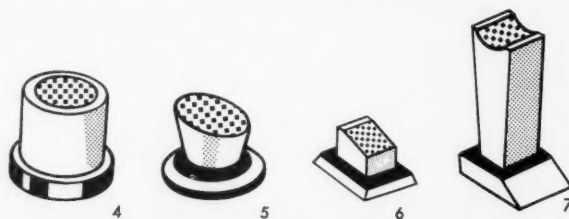
- (1) Determine what the control must do.
- (2) Under what conditions is control used.
- (3) Make sketches of possible control design.
- (4) Refine sketch design for minimum cost.

Design every control for specific use and operating conditions. For example, the control knobs on a portable television set are designed to operate under ideal lighting conditions in the home. This same set, if used under very poor lighting conditions, would require a control knob with an indicator skirt (fig. 1), in combination with back lighting for easy reading. The illustrations indicate various types of hand control and factors pertinent to their design.

Three popular rotary controls with skirt, pointer or both. A knob skirt should be $\frac{3}{4}$ in. wide for easy reading, with a knob of $\frac{1}{4}$ to $\frac{3}{8}$ in. diameter. In crowded spaces, extend the knob 2 in. and add a pointer to the skirt (fig. 3). Critical adjustments require a larger knob diameter, whereas non-critical adjustments are satisfactory with small knob diameters. Use detents if adjustments are short spaced or where vibration is evident.



Push surface buttons should have an area large enough to fit the finger tip comfortably. Generally $\frac{1}{4}$ by $\frac{1}{2}$ in. minimum is excellent. A click sound should indicate when the button is fully depressed. The height of the button should not exceed 1 in. for ease of operation.



Toggle switches must have a visual cue of 30 deg in either on or off position. A length of 1 in. by $\frac{3}{16}$ diameter is a good average size for toggle switch size.

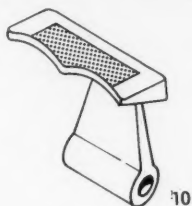


Bar switches operate best with detents to aid positioning of the bar; bar height $\frac{3}{4}$ in. by $1\frac{1}{2}$ in. long.



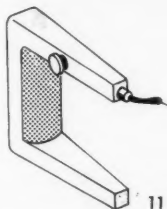
9

Pull bars should have a grip area of at least 4 in. across; height $3\frac{1}{2}$ in. minimum; a visual cue of 30 deg at each stop position. Pulling force for control, about $3\frac{1}{2}$ lb.



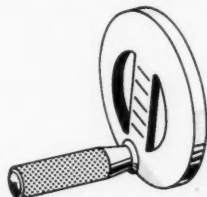
10

The horseshoe grip handle is excellent in combination with trigger buttons. Inside height of grip 5 in. minimum by $\frac{3}{4}$ in. diameter.



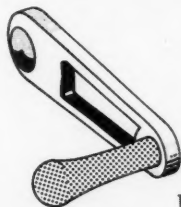
11

High speed cranking is best done with flywheel cranks for easy finger and wrist action. Grip handle, 5 in. long by $\frac{5}{8}$ in. diameter. Crank force between 2 and 4 lb for ease of cranking.



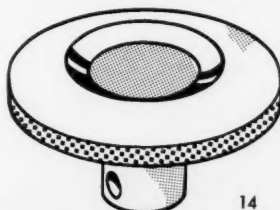
12

Slow, heavy crank controls are best for big loads. Loads of 6 lb or more are easily handled with an arm crank. Grip size $1\frac{1}{4}$ in. diameter by 6 in. long. Length of arm depends on the load.

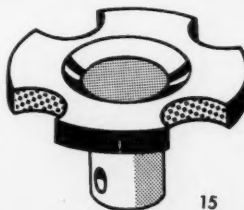


13

Handwheel design depends on the holding action required. Firm-holding wheels may have a smooth periphery, but for positive holding action a fluted edge works best. Wheel diameter, $5\frac{1}{2}$ to 6 $\frac{1}{2}$ in. Allow a minimum space of 1 in. between the product surface and the under surface of the wheel, for the fingers.



14



15



Four men up and ready to roll, the Harrier presents a workmanlike if unglamorous appearance sat in the grass.

Sixty second wonder — car from coffin

John W. Dennis ASSISTANT EDITOR

One of the eye-openers at the 1957 air display in Farnborough, England, was the transformation of a coffin-like box to a small four-passenger car in one minute.

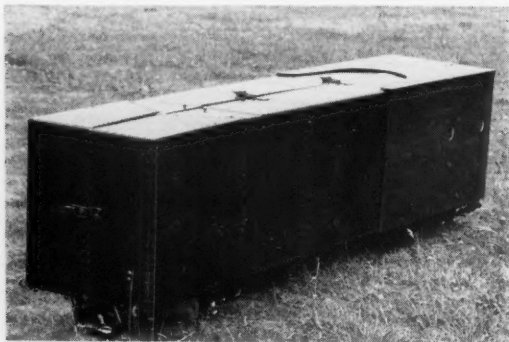
This amazing little machine which scales a mere 700 lb when folded, has been designed by **Hunting Percival Aircraft** and goes under the name of the Harrier.

The Harrier is intended for use by airborne forces and, although it only cuts its weight advantage over a jeep by one quarter, its space advantage is such that 10 Harriers can be packed into the space that a normal vehicle would occupy. It gains further advantage from its design in that folding Harriers can be stacked like packing crates and do without the need for racks.

Folded dimensions of the half-pint vehicle are 20 in. x 28 in. x 104 in. and there seems to be some justification for the claim that Harriers could save their own cost in aircraft gasoline on a single operation if used instead of conventional vehicles.

Hunting chose an air-cooled BSA ohv vertical twin for powerplant, rear-mounted on a central chassis tube. The 650 cc engine delivers its power through a four-speed motorcycle gearbox which dispenses with a reverse gear. The drive is by chain and there is no differential. Rack and pinion steering, independent suspension at all four wheels, cable-operating brakes, no clutch pedal, fuel tank within the steering column support and an electrical fuel pump are some of the other features squeezed into this small package.

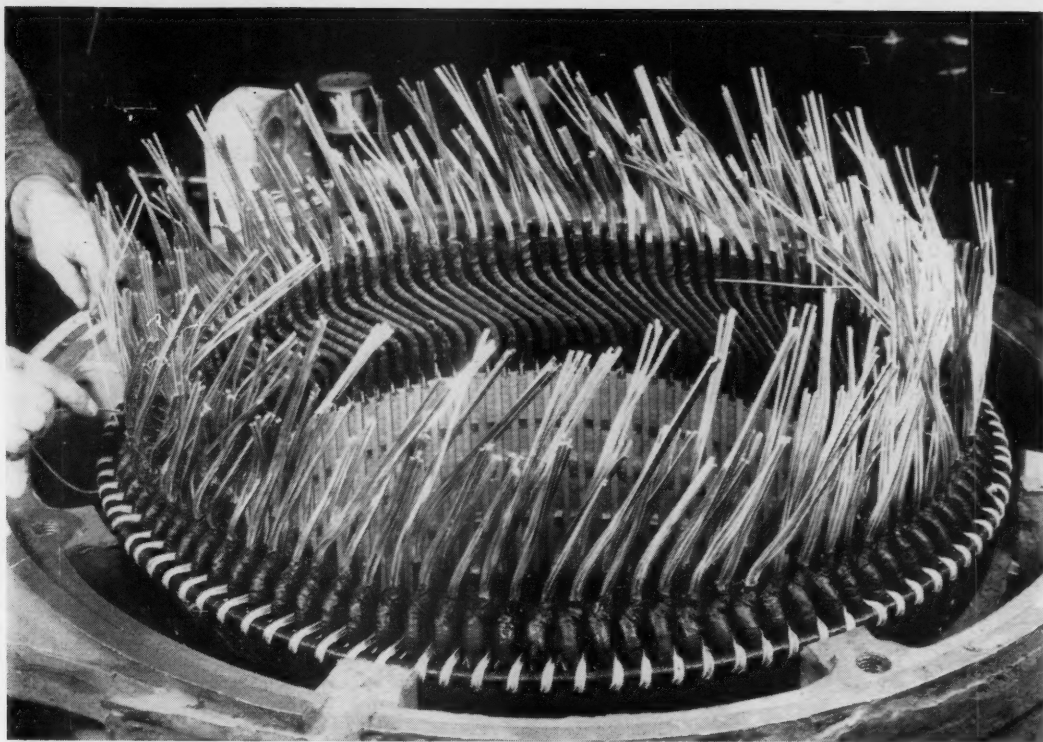
For basic transportation at a minimum of weight and space, the Harrier seems to be a neat answer.



First stage in the transformation. An unassuming box.



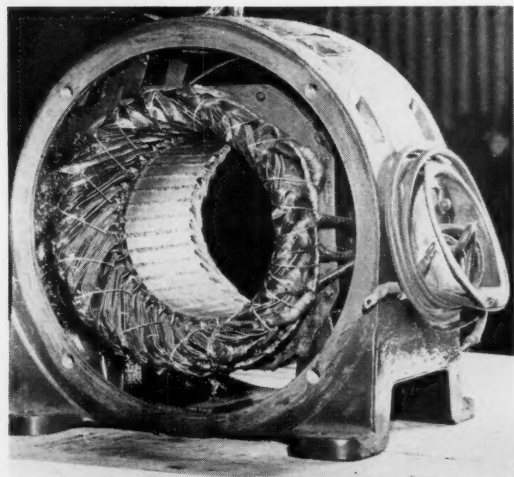
Partly hatched, car's suspension swings out and down.



Stator coils in a large electric motor being tied to a surge ring. Fiberglas cordage is being used for this.

Glass in cordage licks heat problems

Developed originally for electrical tying applications, Fiberglas cordage has gained wide acceptance in areas that require continuous strength under static tension, high temperatures or severe electrical stresses. The cordage enjoys universal use in high-temperature applications, and is used widely in place of cotton and linen in the manufacture and repair of lower operating temperature equipment.

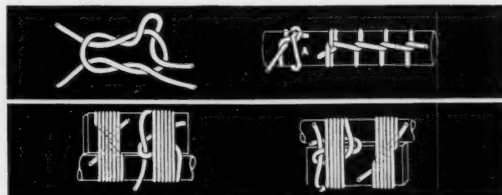


Typical uses include: lacing and binding field coils; banding small armatures; coil filling; banding armature coil leads and commutator V-ring extensions; re-set strings; lashing coils in large motors and generators; and binding and lashing transformer coils and solenoid coils.

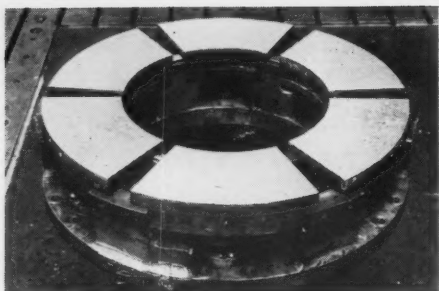
It is also used extensively in wire harnesses and in the construction of special types of wire and flexible resistor.

Manufactured from continuous filament yarns plied in a balanced construction, the cordage has these marked advantages for electrical applications:

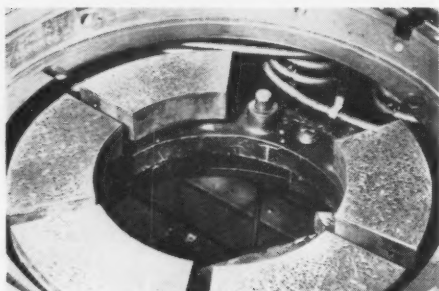
- inorganic
- high thermal conductivity
- exceptional strength
- dimensional stability
- rotproof
- excellent resistance to heat, moisture, oils, corrosive vapors and most acids.



Suitable methods for joining and tying off Fiberglas.



1. Generator Kingsbury thrust bearing shoes.



2. Similar view with one of the shoes removed.

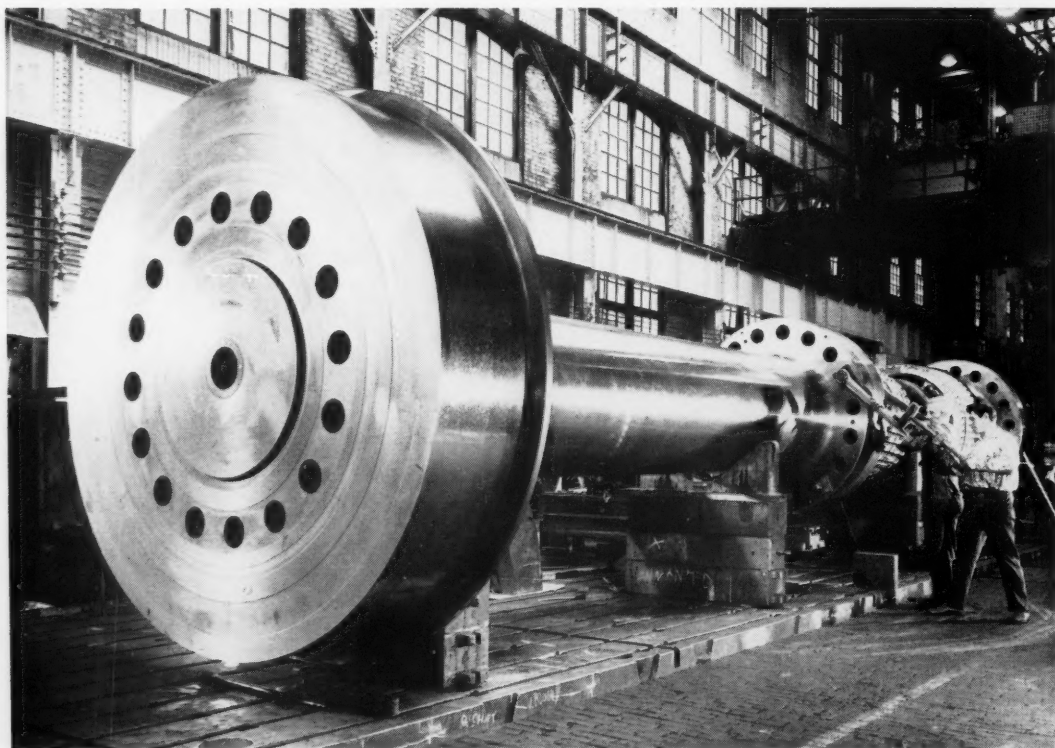
The modern umbrella type, water wheel generator, designed by Canadian Westinghouse and English Electric for the St. Lawrence Seaway, consists basically of a horizontal generator rotor (revolving inside a stator core) bolted to a vertical shaft, the lower end of which is connected to a water turbine, which drives it (see Fig. 4).

Tilting pads make up

A big advantage is that the powerhouse

An important feature is the Kingsbury type combined guide and thrust bearing located below the generator rotor; there is no bearing above the rotor.

The Kingsbury bearing is a tilting pad bearing in which each of 4 pads (shoes) is free to tilt, or pivot. It is thus able to take up its most effective position.



3. Giant steel shaft for one of the eight St. Lawrence power generators. This single component weighs 58 tons.

a generator bearing

will quite possibly be less expensive

The principle of operation is given in the diagrammatic sketch (Fig. 5). When the loaded plate (runner) is stationary, the shoes lie with their surfaces parallel to its face. As the runner plate starts rotating, a tapered oil film is formed between the shoe and the runner, and the pads tilt to the angle that generates the proper distribution of film pressure.

Each of the shoes is in the form of a wedge (see Figs. 1, 2 & 6). The pivot line is radial, so that each shoe can be inclined in a circumferential direction in order to provide a tapered oil film.

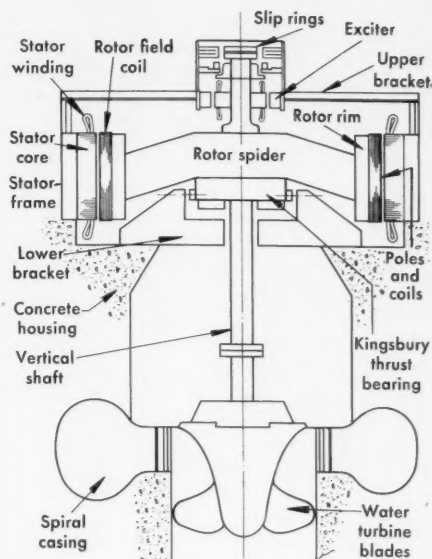
Lubricating oil is fed to the centre of the housing near the shaft and expelled at the outer edge, by the pump action of the bearing.

As well as the somewhat lower first cost of the umbrella type machine (because only one guide bearing is necessary), one decided advantage of the umbrella type generator is that it generally permits a less expensive power house than would be required with the conventional 2 guide bearing types of generator. With the conventional machine (with its shaft extending up through the upper bracket, through the thrust and guide bearings and, in some cases, even up into the exciter rotor), considerable height is required to lift the rotor, so that the bottom of the generator shaft flange clears the generator stator. With the Westinghouse umbrella type machine, the rotor is bolted and dowelled to the top of the generator shaft and can be readily unbolted and removed. The short generator shaft may then be lifted up and removed.

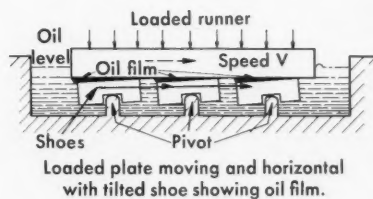
The generator rotor is bolted to the end of the shaft (Fig. 3) and may be completely removed without disturbing the alignment of the shaft or thrust bearing. The thrust bearing shoes may be adjusted or replaced (without disturbing the rotor or shaft alignment) by means of a thrust bearing lowering device. The guide bearing shoes can be removed without disturbing the generator rotor.

Both bearings are easy to remove or inspect without taking out the rotor or breaking the shaft's coupling. ★

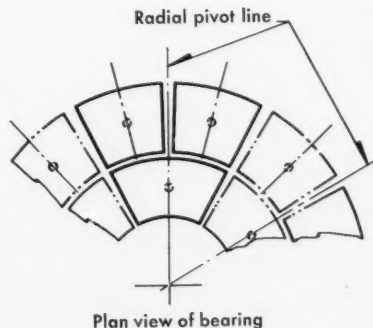
How it works



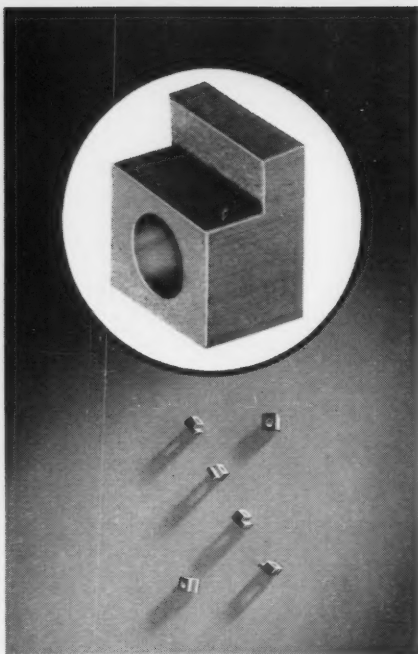
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5



6



Nickel silver in powder metallurgy

Powder metallurgy is finding increasing favor as a method of producing metal parts. Basically, the process includes the following operations:

- (1) a die cavity is filled with powdered metal that has been mixed with a lubricant;
- (2) pressure is applied, with two or more punches operating vertically, and released;
- (3) the part is ejected upward from the die;
- (4) the part is sintered in a furnace at temperatures ranging from 840 to 950 C.

Because of the simplicity of the process, production rates of 500 to 1,000 parts an hour are not unusual, and tolerances as low as 0.002 in. per in. have been met on a production basis. Cost savings of more than 75% over previous production methods are not uncommon.

Of the powders produced by The New Jersey Zinc Company, the nickel-silver powders have certain definite advantages for some purposes. Powder 1601 contains 64% copper, 18% nickel, 18% zinc. No. 1606 has 70% copper, 10% nickel, 20% zinc; powder 1607 has 64% copper, 18% nickel, 16.5% zinc, 1.5% lead.

While toughness and corrosion resistance are factors

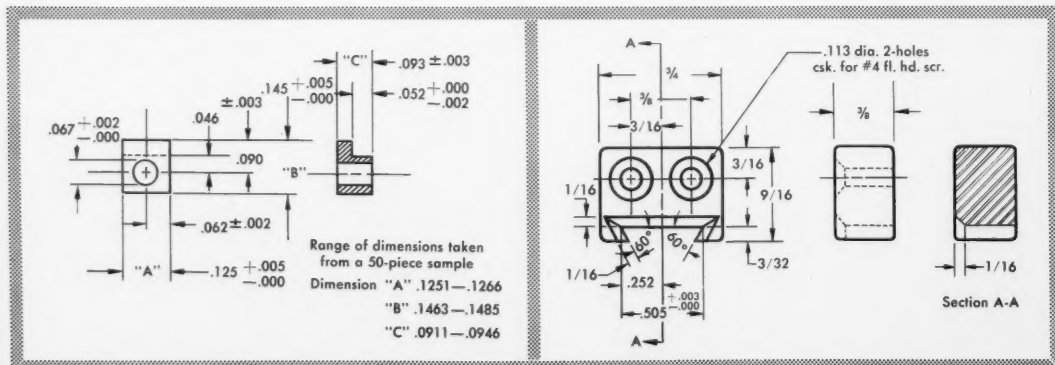
in the selection of nickel-silver powders, the most important aspect is the ease with which the nickel-silver can be given a lustrous and lasting finish.

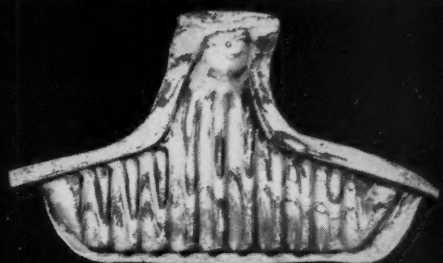
The Kearfott Company's aircraft gyro clamp of nickel-silver (shown in Fig 1) is a good example of the degree to which part size can be controlled in the powder metallurgy process. Blueprint limits for dimension

"A" of this part were $0.125 \begin{smallmatrix} +0.005 \\ -0.000 \end{smallmatrix}$ in. A measurement of 50 production samples of the part produced by powder metallurgy gave a range of 0.1251 to 0.1266 in. for this dimension, a range well within specifications.

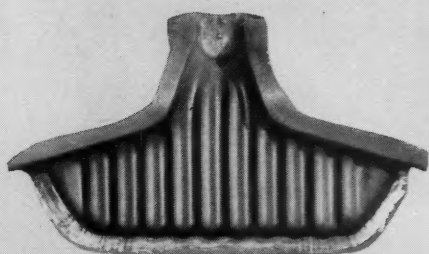
Similar results were obtained for the other dimensions, as shown in Fig 1. A cost saving of 88% was the result of producing this part as a nickel-silver sintering, over the previous method (machining brass).

Fig 2 shows a guide block (used by Rapidprint Time Recorders, Inc.) which is pressed from nickel-silver powder and buffed to a high lustre. It was formerly shaped from cold-rolled steel, involving milling, drilling, reaming, countersinking and plating operations. The new method of production saves 68c a p.ece. ★

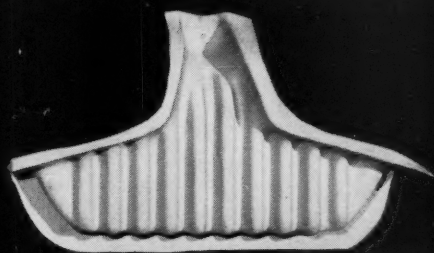




Uncoated-heated 1900F - 10 min.
Pickled 3 min. 120F



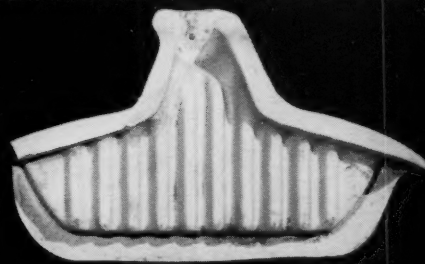
Coated with Turco 4367. 17-7 PH



Coated-heated 1900F - 10 min.
Pickled 1 min. 120F.



Uncoated-heated 1900F - 10 min.



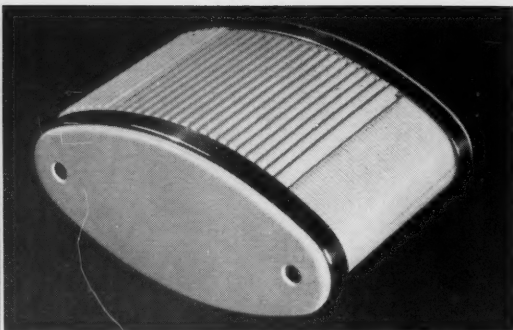
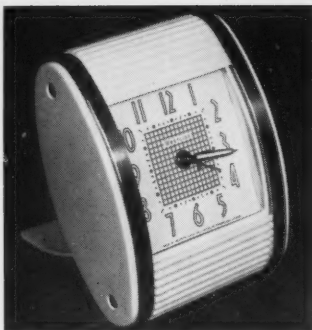
Coated-heated 1900F - 10 min.

Compound inhibits the formation of tenacious scale

A compound that inhibits the formation of tenacious scale on stainless steel, nickel-chrome and alloys of cobalt, titanium and copper during heat treatment is known as Turco 4367. So effective is it that there is no need for controlled atmosphere furnaces in the high temperature heat treatment of these metals.

The compound is also used as a lubricant in the hot forming of titanium and the hot flaring of titanium tubing; as a cold lubricant for forming 17-7 steel plate in the hydro press; and in the annealing of copper.

Turco 4367 was developed by the Materials and Process Laboratory of North American Aviation, Inc. ★



A handsome traveling companion, the Westclox Travalarm is available to its buyer in a black or ivory colored case of Fortical plastic. This plastic, by Canadian Chemical Co., has a Rockwell hardness of 62-94 and a percentage moisture gain of 1.5-1.8. (200)

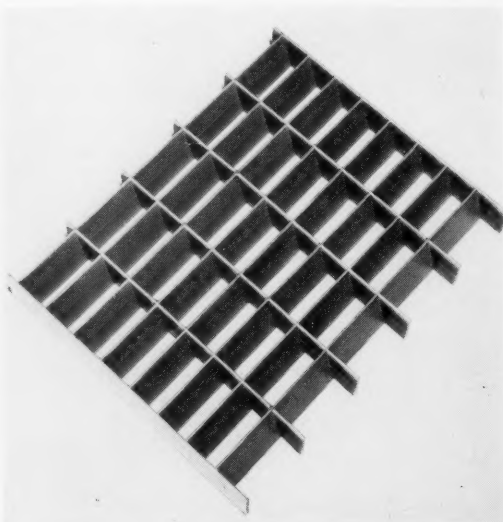


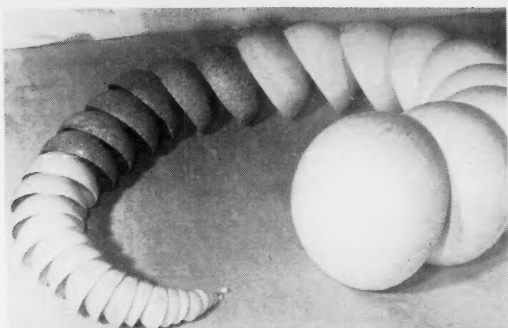
The Deputy United Kingdom High Commissioner in Canada (Designate), the Hon. F. E. Cumming-Bruce, examines the low pressure blading for the Richard L. Hearn power station for Ontario Hydro during a visit to the works of the British firm which built it. (201)

Design news in pictures

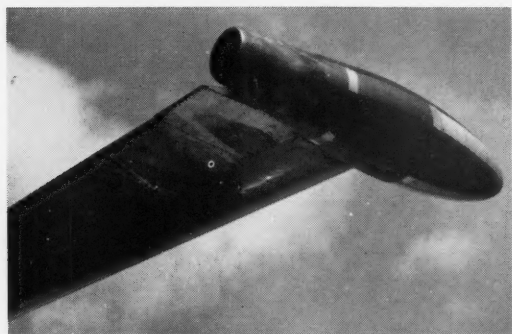
Winner of a NIDC Design Award in 1955, this cast aluminum fireplace accessory from Victoria, B.C., has been on the market since 1954. Handle of the item is of birch and the metal is in black. Retail price of this fire iron is \$10.95. (202)

Designed to go into the top of Dominion Electrohome's humidifier (Humidaire), this screen is injection molded from high impact styrene. The design of the louvers allows the direction of the air to be reversed by reversing the screen. (203)





Cups from an omni-directional reflector lens. Made of artificial dielectric material, it will redirect incident energy through a 180-deg. reflected angle. (204)



A tip jet unit from the Fairey Rotodyne (which is a VTOL aircraft). Its major components were fabricated from Nimonic alloys and welding was widely used. (205)



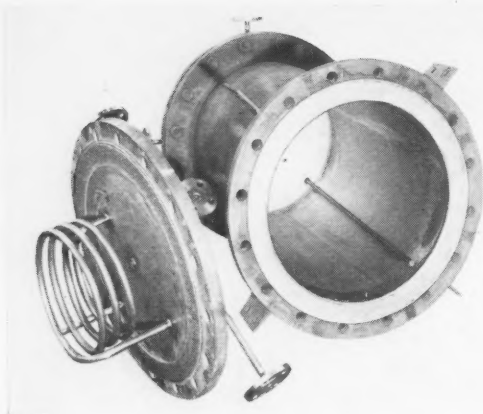
Each year the National Industrial Design Council in Ottawa awards stamps of approval for designs of excellence. This microphone was a winner in 1958. (206)



"Drive-in" telephones developed by Bell Telephone Laboratories promise a convenient roadside service for the lazier motorists among us. The protective hood for the installation is vacuum-formed of Tenite butyrate. (207)

Ideas round-up

Titanium: it's use may allow a size reduction



With plant specially designed to use titanium, it is now possible to handle certain corrosive chemicals and carry out chemical processes that were impossible on an industrial scale. **Imperial Chemical Industries, Ltd.**, asserts that anodically protected titanium carrying a small impressed current can now be considered for use in some of the most aggressive environments known to chemical engineers.

Although titanium is at present more costly than conventional structural metals, there are many instances where its properties may permit the redesign of plant equipment to reduce its size. In this way, such equipment in titanium would compare favorably with equipment made in conventional materials.

Products include large lined vessels and a variety of fabricated products such as valves and valve plates, gas nozzles, agitators, anodising jigs and complete heat exchange units. (210)

Diaphragm: Teflon meets the temperature and sterility requirements

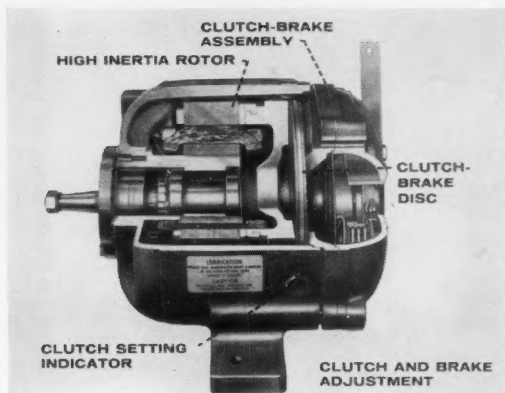
By developing a special technique for shaping Teflon (tetrafluorethylene), special valve diaphragms for the manufacture of Salk polio vaccine were supplied by the plastic products division of **Raybestos-Manhattan, Inc.** The only plastic material that met the combined temperature and sterility requirements was Teflon, which is almost completely inert chemically and which can operate without difficulty in the temperature range from -400°F to $+500^{\circ}\text{F}$.

What was needed was a thin diaphragm of perfectly uniform thickness. Such a component would not have been too difficult to machine from Teflon sheets, if it had been flat and circular. But it wasn't. In the centre, a spherical segment rose to a nipple. Around the rim was a reinforcing ridge. The diaphragm was rectangular, and at each corner there was a hole that the reinforcing ridge had to circle.

Such a shape would have been comparatively simple to mold from a plastic (like polyethylene) that will melt and flow. But Teflon does not melt or flow. This meant that the diaphragm had to be shaped and cured by completely new methods. (211)



Clutch brake motor: stored energy for smooth fast starts



Clutch-brake motors, available from **Ferguson Machine Corporation**, use a constantly rotating, high inertia rotor to provide stored energy for smooth, fast starts under suddenly applied loads in metalworking and automatic production machinery. The clutch-brake assembly (integral with the motor) is actuated by a lever operated by a double-acting solenoid or air (or hydraulic) cylinder. Upon actuation, the lever engages the clutch with the continuously revolving rotor. Instant power (with minimum fluctuations in speed and motor current) results and impulse applied loads, up to ten times the rated value of the motor, can be accommodated. Opposite actuation of the lever disengages the clutch and causes a powerful brake to stop the output shaft. The units are designed so that the clutch-brake assembly can be removed from the housing without disconnecting the motor from its mounting. Adjustments can, however, be made externally without taking down the motor. Clutch and brake wear surfaces are mounted on one disc for easy replacement. Linings are of cork (or a special composition) to provide high accelerating and braking torque while permitting smooth control for jogging or momentary slow speed operation. Standard motors range from $\frac{1}{2}$ to 5 hp.

(212)

Rod end: lifetime lubrication an attractive feature

A new type of rod end (combining features of precision manufacture with high production manufacturing techniques) is now offered by **Automation Bearings Corporation**. It is used in commercial and industrial applications.

Construction of the rod end is by two-piece style, the ball-housing being swaged around the ball by specially designed equipment, in such a way that there is the largest possible surface contact area between housing and ball. The standard housing and shank material used is high tensile, pearlitic malleable iron (rated at 70,000 psi). Other alloys are available. Two basic types of ball are used: SAE-52100 alloy steel, hardened and ground, then hard chrome plated; and sintered steel balls, hardened and ground, and treated with a high pressure, dry film lubrication coating.

Lubrication

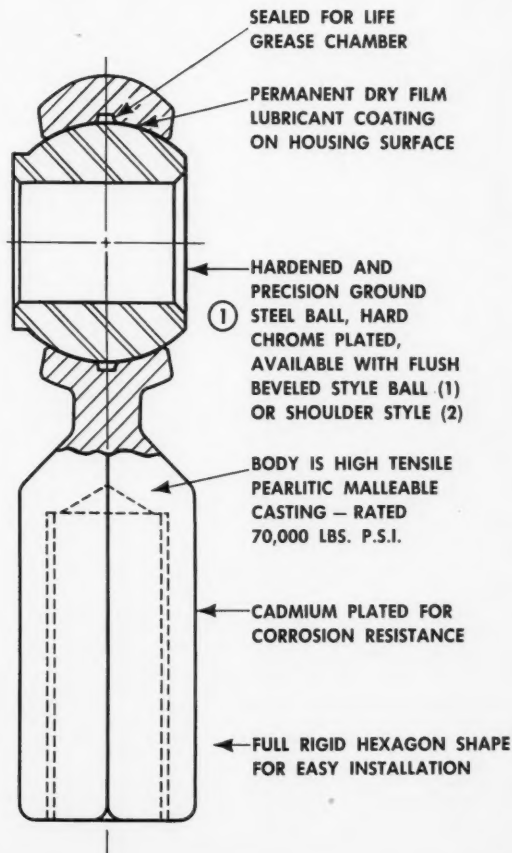
Lifetime lubrication features make the A.B.C. rod end especially attractive to design engineers. The ball housing surface has a permanent dry film lubricant coat. Additional high-quality lubricant is supplied from the sealed-in-grease chamber; this provides an extremely low coefficient of friction and sufficient lubrication for lifetime operation in average applications. A lube fitting on the rod end is available for applications where rugged duty may require occasional re-lubrication.

The body is cadmium plated to prevent corrosion. The full hexagon shape of the female rod end and the heavy throat base of the male rod end make installation easy with a simple wrench.

Also available: shoulder-style balls that increase misalignment capacity and dispense with the need for an interposed washer when assembling into a yoke or connecting shaft.

Both female and male types are available in standard bore sizes from $\frac{1}{4}$ to $\frac{3}{4}$ in.

(213)



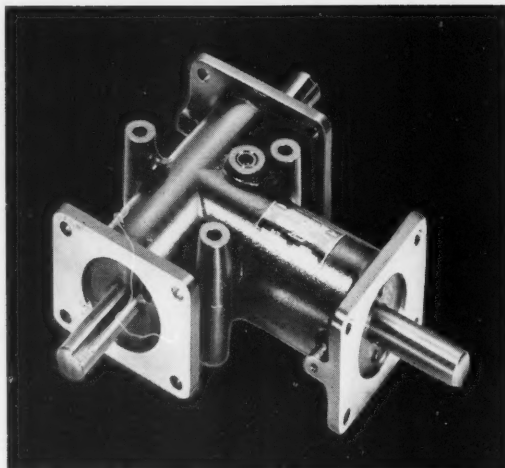
Right-angle bevel gear unit

Airborne Accessories Corporation has expanded its line of aircraft ANGLgears with the addition of a new 2¼ hp model.

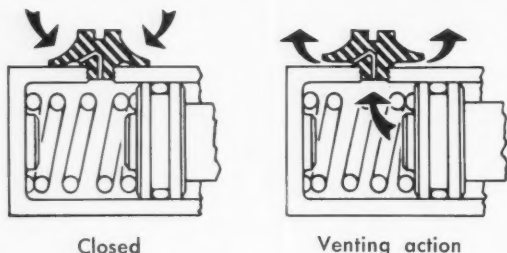
Designed specifically for airborne applications, the right-angle bevel gear unit can be used as an original equipment component or for replacement and repair use. It is available in either 2-way (Model AR-333) or 3-way (Model AR-335) transmission styles and with either 1:1 or 2:1 gear ratios.

The line now includes 12 models, ranging from 1/3 to 2¼ hp, for use in either manual or power-operated transmission systems.

High load capacity, compactness, minimum maintenance and quiet operation are features of this type of right-angle transmission. Airborne ANGLgears are the only right-angle bevel gear units with flanged end-mounting and three-bolt side-mounting that allow the units to be installed in practically any position desired. (214)



Plastic seal: excess gas escape for liquid rocket engines



A tiny plastic seal (about the size of a thumbnail) helps assure the reliability of the liquid Rocketdyne rocket engines used to power U.S. ballistic missiles.

The tiny seal (trademarked "Navent") is a mushroom-shaped, nonmechanical valve that permits pre-

cision rocket engine assemblies to "breathe-out" excess or escaping gases without sucking in contaminants.

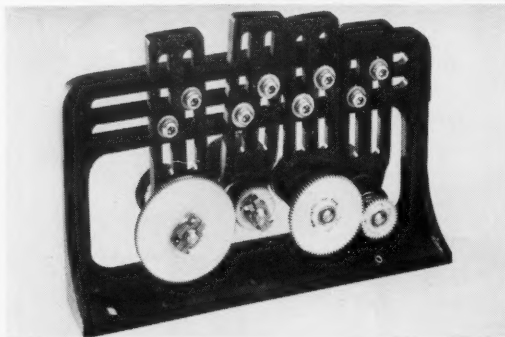
Propulsion engineers of Rocketdyne (a division of North American Aviation, Inc.) invented the plastic mushroom valve during the development of powerful rocket engines for the Atlas, Thor, Jupiter and Redstone missiles.

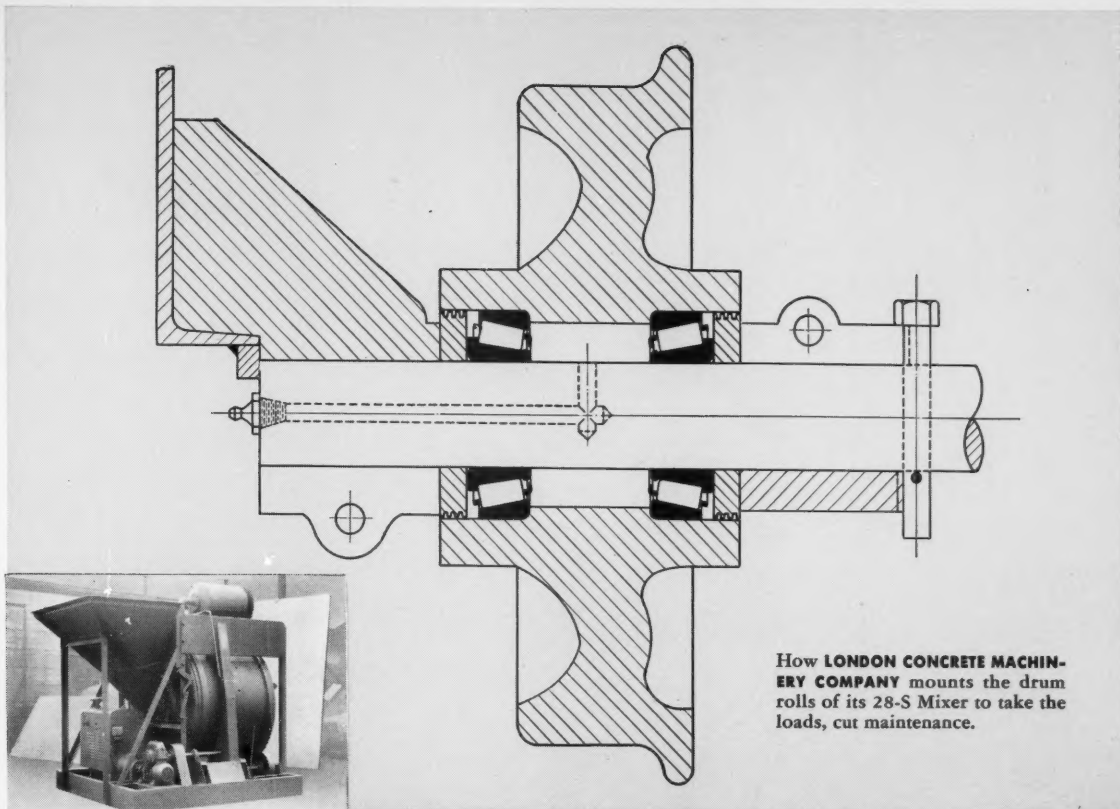
Conventionally, a vent is a small hole drilled in the body of a valve assembly. Contaminants and moisture can freely enter; it can be frozen closed; or inadvertently covered with accessories. The Navent seal does away with these disadvantages.

In addition to these rocket engine applications, the valve (in its various sizes) promises to be of great value in venting hydraulic, refrigeration and air-compressing systems. (215)

Hanger: complete gear trains assembled as a single unit

Sterling Precision Corp. now has a hanger that helps the servo engineer obtain the optimum in breadboarding. The mounting centres of this assembly are spaced for use with most existing breadboard plates. It permits the assembly of a complete gear train as an integral unit: this means that large reductions (having several meshes) can be set up independently, prior to mounting on the breadboard plate. The bores are set in accordance with the recommended bearing mounting specification for precision fits. The flexibility allows for simple adjustment for low backlash adjustment. The rigid aluminum alloy castings are accurately machined for squareness. A maximum of six vertical adjustable hangers can be mounted on the main frame. The unit is finished in black anodize. (216)





How **LONDON CONCRETE MACHINERY COMPANY** mounts the drum rolls of its 28-S Mixer to take the loads, cut maintenance.

Monster mixer stays on the job as **TIMKEN** bearings take monster loads

WHEN London Concrete Machinery Co., London, Ont., built this monster 28-S Mixer, they designed four drum rolls to take the tremendous loads encountered in mixing tons of concrete. To make doubly sure there would be no load problems, they mounted each drum roll on two Timken tapered roller bearings (see diagram above). Here's why:

1. **Full-line contact** between rollers and races gives Timken bearings *extra* load-carrying capacity to stay on the job day after day, year after year.
2. Their **tapered construction** lets

Timken bearings take radial and thrust loads in any combination. They *roll* the load, keep machines working with minimum maintenance.

3. **Shock loads are no problem** because Timken bearings are case-carburized—have hard, wear-resistant surfaces and tough, shock-resistant cores on both rollers and races.

That's why Timken bearings prevent breakdowns—why they cut maintenance costs to a minimum. And closures are more effective because Timken bearings hold shafts concentric with housings. Dust stays out;

lubricant stays in. Timken bearings *roll* the load for years, normally last the life of the machine.

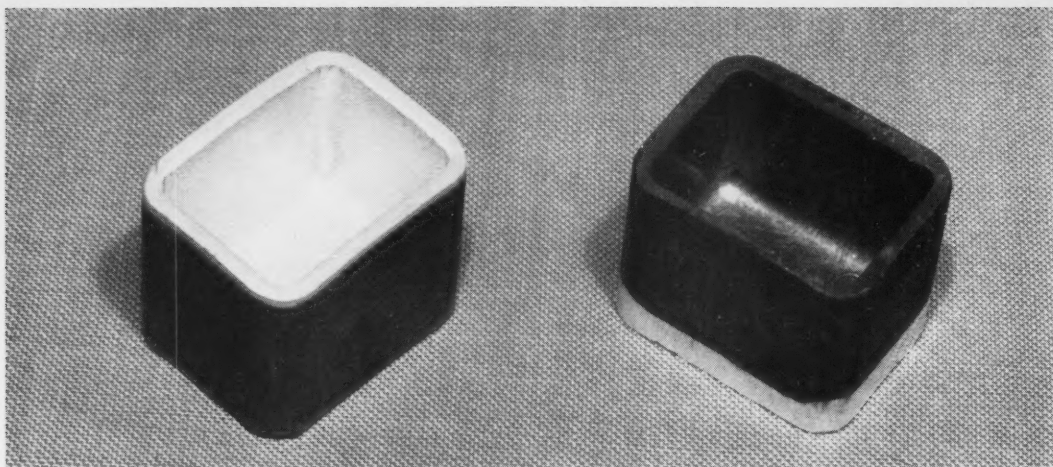
Make sure you get all these money-saving advantages, get the most from your machine. Specify Timken bearings because *BETTER-ness rolls* on Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio, U.S.A. **CANADIAN PLANT:** St. Thomas, Ontario. Cable address: "TIMROSCO".



This symbol on a product means its bearings are the best.

TIMKEN *Made in* **CANADA**
TRADE-MARK REG. IN CANADA AND U.S. PAT. OFF.
TAPERED ROLLER BEARINGS





1. These impacts are 6011 aluminum clad both internally and externally with 1100 aluminum. Dye shows contrast.

Impact extrusions are filling new roles

In a recent SAE lecture by R. A. Quadt (vp, Research & Development, Bridgeport Brass Company), new trends away from small, simple impacts in soft aluminum alloys were cited. Among these are longer, larger and more complex impacts in stronger, heat-treatable aluminum alloys and in compacted sintered aluminum powder for higher temperatures. Large complex parts are produced at Hunter Douglas Aluminum Division having multiple O D's and I D's, non-symmetrical cross-sections, and bosses mid-length on their O D's or I D's.

For many years the use of aluminum impact extrusions was confined to non-stressed applications.

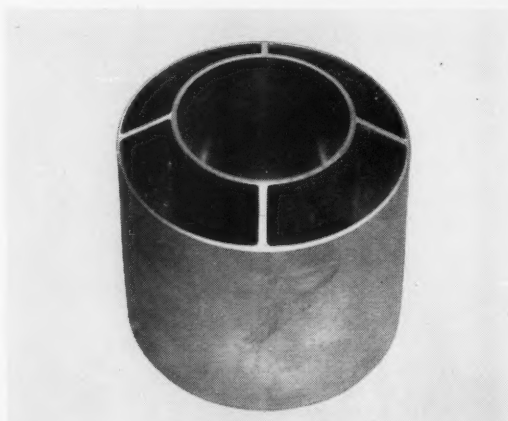
Generally the aluminum was commercially pure 2S or other low alloy, moderate strength composition. Very little use was made of the harder, heat-treatable analyses because of the higher cost associated with heat-treatable parts and the inherent difficulties with tools, presses and lubrication designed for the softer materials.

Many of the restrictions have been overcome, however, by developments in the last few years. The problems associated with strong heat-treated alloys have been solved by improved techniques for producing extrusion blanks, new lubricants and application methods, more rigid tooling and fast acting hydraulic presses.

Probably one of the most complicated impact extrusion assemblies produced to date is a complex, closed end tube in alloy 2014-T6. The walls are .050 in. and the length 100 in. One end is closed with internal and external ribs, three internal ribs of different size run the full tube length and a single external rib is included for assembly purposes. These external ribs are machined the full length into male and female dovetails. Assembly is accomplished by sliding the mating parts together over the entire 100 in. length (Fig. 3).

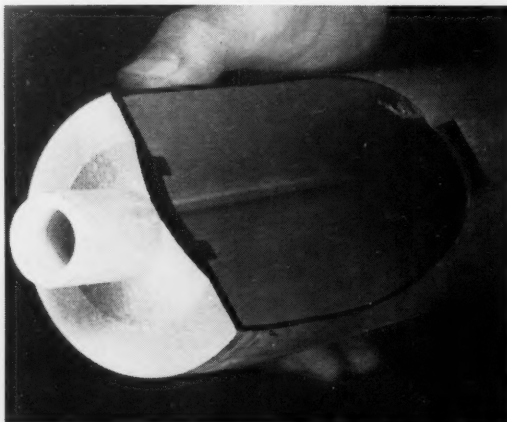
Fig. 2 shows a one piece shrouded rocket tail fin. Fabricated as a one-piece heat treated impact, it replaced an unreliable six piece welded assembly of lower strength and unacceptable tolerances.

Clad impacts (Fig. 1) coextruded impacts, impacts with inserts: all these and more are available to the imaginative designer. ★



2. One-piece shrouded rocket tail fin—no assembly.

3. Dovetail joint is machined from the rib at right.



**Now... in tolerance
ranges to fit your
equipment needs...**



J-M Die-formed Packing Rings for all process fluids

Whether you are designing a bathroom fixture or a high-pressure valve, you can now choose your packing rings with greater certainty of both maximum sealability and easy assembly. For Johns-Manville has grouped its die-formed packing rings into three tolerance ranges—*dense*, *soft* and *metallic*—to fit your equipment needs.

Johns-Manville Die-Formed Packing Rings are precision-made for many fluid services including oils, tars, corrosives, solvents, fresh and salt water, steam to 1200 F, pressures to 4000 psi (on special valves to 60,000 psi). Special J-M rings with controlled friction are made for high-grade plumbing fixtures.

Check the tolerance chart below

Lasting corrosion protection for valve stems in storage. Ordinary corrosion inhibitors fail to protect after the sacrificial metal is consumed. J-M No. 9 operates on an entirely different principle. Photograph shows how, under accelerated tests, the sacrificial inhibitor (at left) failed after a few weeks but the valve stem protected by J-M No. 9 (at right) was clean months later. Specify J-M No. 9 inhibitor when you order J-M die-formed packing rings.

... your Johns-Manville Packing Representative will be glad to give you lists and descriptions of the styles in each range and those with which the J-M No. 9 Corrosion Inhibitor (see right above) may be specified or is standard. Write to Dept. IA, Canadian Johns-Manville Co. Ltd., Port Credit, Ontario.

JOHNS-MANVILLE DIE-FORMED PACKING RING TOLERANCES

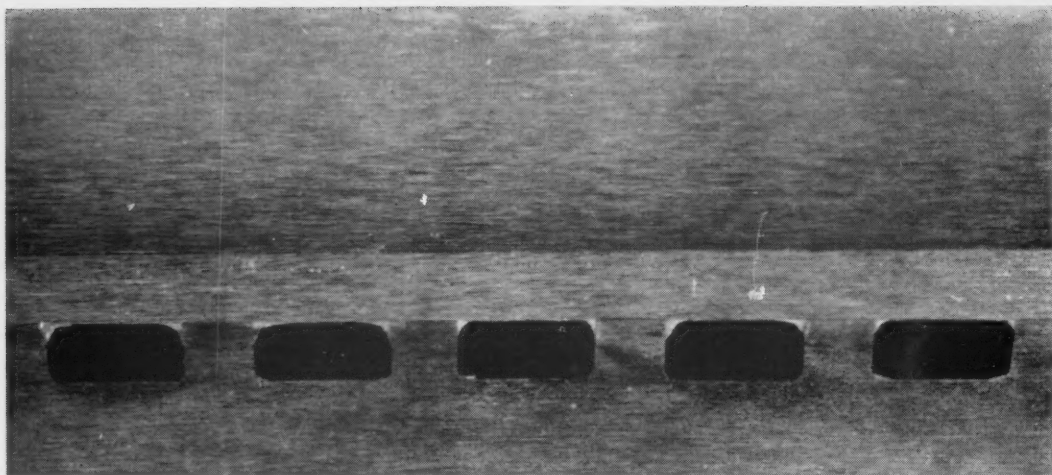
	DENSE RINGS (including plastics)			SOFT RINGS (including cloth rings)			METALLIC RINGS		
	I.D.	O.D.	Depth	I.D.	O.D.	Depth	I.D.	O.D.	Depth
to and incl. ½" O.D.	+.008" -.000"	+.000" -.008"	± 1/64"	+.008" -.000"	+.000" -.015"	± 1/64"	+.008" -.000"	+.000" -1/32"	± 1/32"
Over ½" to and incl. 1" O.D.	+.008" -.000"	+.000" -.008"	± 1/32"	+.008" -.000"	+.000" -.015"	± 1/32"	+.008" -.000"	+.000" -1/32"	± 1/32"
Over 1" to and incl. 2 ¾" O.D.	+.008" -.000"	+.000" -1/64"	± 1/32"	+.010" -.000"	+.000" -1/32"	± 1/32"	+.008" -.000"	+.000" -1/32"	± 1/32"
Over 2 ¾" O.D.	+.010" -.000"	+.000" -1/32"	± 1/32"	+.010" -.000"	+.000" -3/64"	± 1/32"	+.008" -.000"	+.000" -1/32"	± 1/32"

Bevel (on all styles) = 5° when required



Johns-Manville PACKINGS, GASKETS and TEXTILES

I-3044



Type 405 stainless on carbon steel. Small fillets formed at vacuum bonding line eliminate crevice corrosion.

Tunneled plate for rapid heat transfer

New opportunities for using heavy composite plate as a heat transfer medium have emerged as the result of Chicago Bridge & Iron's method of vacuum cladding. The heavy base plate (generally of steel) is channeled before the alloy or nonferrous cladding layer is applied, to form coil-like passageways for a cooling or heating medium in the very heart of the finished clad plate, and at a selected distance from either surface. The new plate with its integral internal coring is aptly named channeled Hortonclad.

The product has already been used for precise surface temperature control in the venturi sections of hypersonic wind tunnels and the heated platens of laminating presses. In reactors and vessels it has provided internal heating (and cooling) of critical partitions.

The use of channeled plate can eliminate bulky surface coils and double-wall constructions in many instances. And the fact that the internal channels are formed by vacuum cladding means new metallurgical freedom in selecting base material and clad surface compositions.

To design engineers, interest in channeled plate centres about the availability of heavy plate in which temperature can be controlled from the inside out. The material can be welded like any other clad, simply by omitting the channeling of the base material along the weld lines. Wide freedom in selecting surface materials, coupled with the ability to develop cored plates of extremely high strength, opens new horizons.

Channel cross sections may vary in size. Depths range from $\frac{1}{4}$ to 1 in. and widths from $\frac{1}{2}$ to $1\frac{1}{2}$ in., depending on the thickness of the cladding.

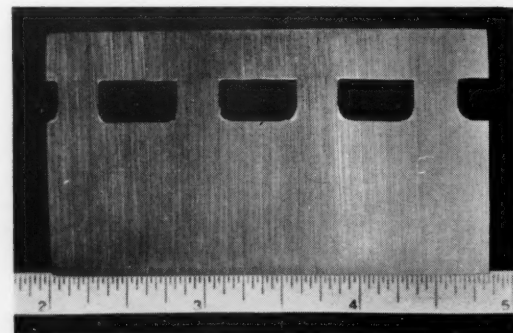
Dozens of cladding and base plate combinations have been successfully used in channeled plate, and many other types are being tested in the laboratory. There appears to be no reason why all the cladding materials available as solid clad plate cannot be used for this channeled plate application. These include austenitic stainless (304L, 316L, 321, 347, 318 and 17-

7PH); straight chromium stainless (403, 405, 410 and 430); and nonferrous materials such as nickel, monel, inconel, hastelloys B, C and F, silver, copper, cupro-nickel alloys, brass and Carpenter 20 Cb. Other less common materials (titanium, zirconium, bronze and tantalum) are foreseen as claddings for channeled plate in the near future.

The most popular base materials, of course, are the low carbon steels of firebox quality, although occasionally other base materials are used for specific properties, as in titanium-on-copper.

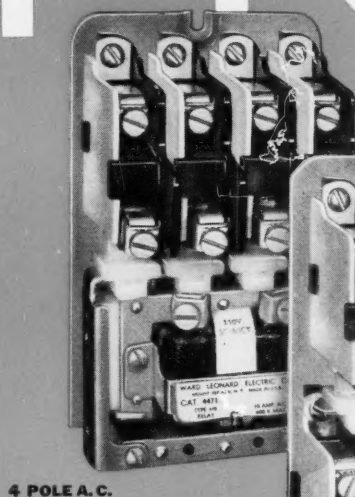
The channeling for the cooling or heating fluid may follow almost any pattern, and the channel layouts for large plates are often divided into independent coil-like sub-layouts, in order to give independent temperature regulation over different sections of the finished materials (as at edges and around openings) and to reduce the pressure drop of coolants and heating liquids by having several "coils" in parallel, rather than one long labyrinth path. Connections are made to the channels inside the finished plate by drilled and tapped holes through the base material. ★

Closeup clearly shows the precision of the channels.

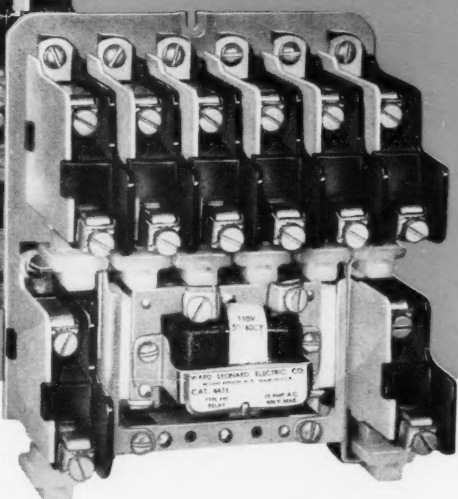


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4 POLE A.C.



- ★ multi-pole
- ★ multi-purpose
- ★ multi-featured

8 POLE A.C.

ENGINEERING DATA

Contact Ratings:

Volts	A.C. Amperes		D.C. Amperes*	
	N.O.	N.C.	N.O.	N.C.
115	10	10	6	5
230	10	10	1	1
440	10	10	—	—
600	10	10	—	—

* Non-inductive resistance loads.

Coils: Standard A.C. coils for 110, 208-220, 440, or 550 volts, 50-60 cycles. Standard D.C. coils for 115 or 230 volts. Other coils on special order.

Poles: 2 to 8, in all combinations of N.O. and N.C. contacts, convertible from N.O. to N.C. and vice versa.

† Dimensions:

A.C.	D.C.	Width	Height	Depth
4 pole	—	3¼"	5½"	3¾"
8 pole	—	5½"	5½"	3¾"
—	4 pole	3¾"	5¾"	3¾"
—	8 pole	5½"	5¾"	3¾"

† Mounting centers for all models are identical.

Brand new, Type HR solenoid relays are Result-Engineered to function as the "heart" of any control system. The Type HR is designed as a multi-pole relay for piloting machine and process control components where ultra-long life and hi-speed operation are mandatory.

Wiping action contacts insure high electrical reliability; nylon movable contact carriers—separate for each pole—and nylon armature guides minimize operating friction. And, you can add to these features, interchangeable a.c. and d.c. power plants with molded coils.

Simple, fast, easy installation speeds assembly into your equipment, saves time, cuts cost. Accessible front connected coil and contact terminals equipped with pressure connectors . . . no lead lugging needed!

Four basic models with up to eight unitized poles maximum; convertible N.O. or N.C. contacts—completely enclosed to keep out dust and foreign particles—make the HR an unusually versatile relay line.

For complete information on the new Type HR solenoid relays, call or write Ward Leonard of Canada Limited, 1070 Birchmount Road, Toronto 16, Ontario.

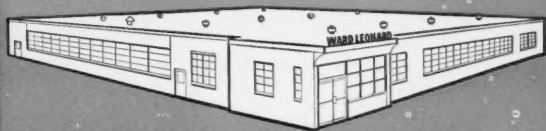
5825

LIVE BETTER...Electrically



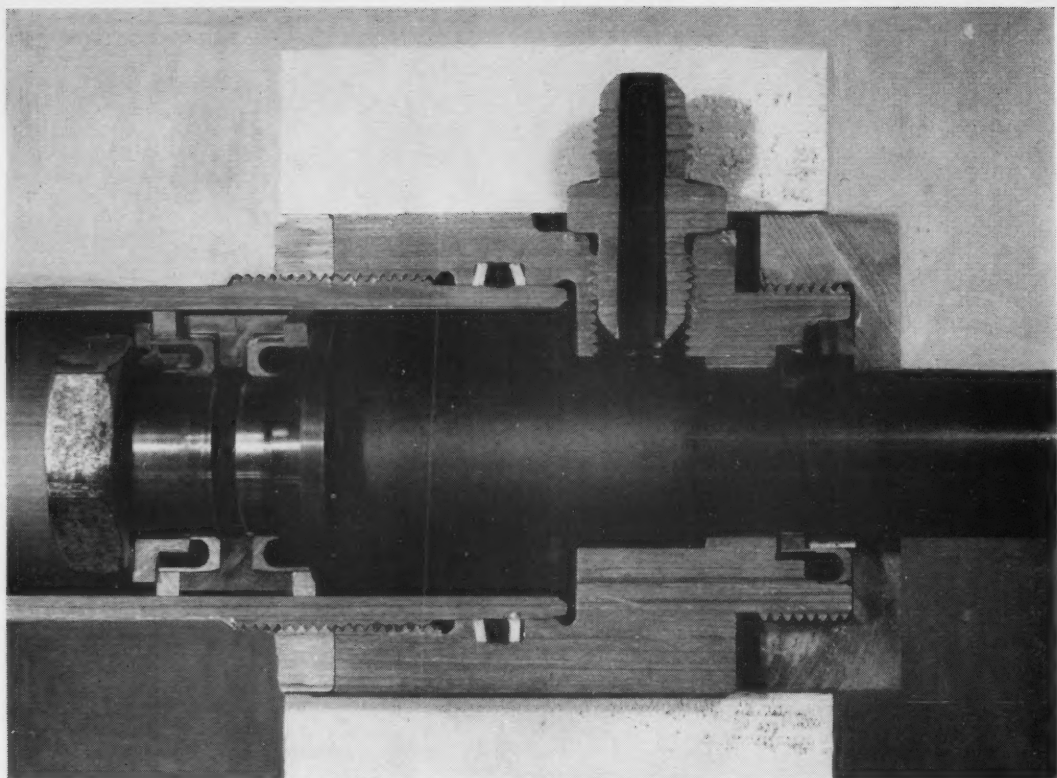
**WARD LEONARD
OF CANADA LIMITED**

1070 BIRCHMOUNT ROAD, TORONTO 16



CANADIAN FACTORY AND HEAD OFFICE

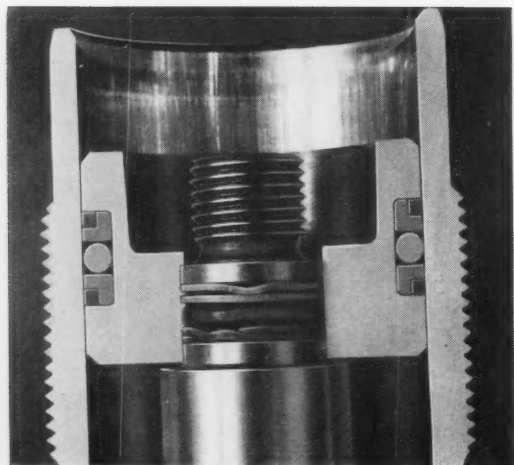
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Cutaway shows metallic seal for hydraulic systems operating at 4000 psi and above and from -65F up to 750F.

Sealing for high temperature systems

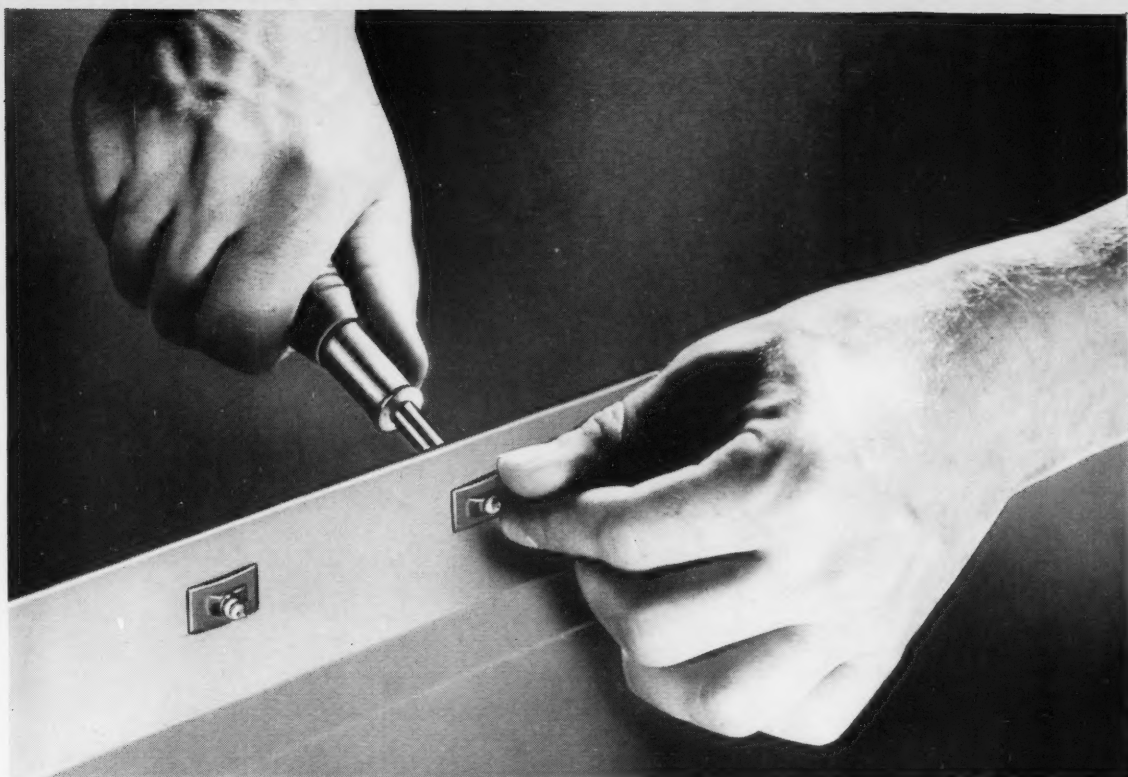
A sealing system handles pressures to 4,000 psi, temperatures to 500F



Two inventions pointing to air vehicles of the future were recently announced by North American Aviation's Los Angeles Division. Both are developments in the sealing of high temperature, high pressure systems. Developed with company funds for hydraulic systems operating at 3,000 to 4,000 psi at temperatures from 65 F to 500 F (or more) the inventions are separate approaches to related sealing problems.

Fig 1 shows a back-up ring designed to be used with conventional elastomeric packing rings. It has been satisfactorily tested, in an airplane landing gear fairing door cylinder assembly, through 100,000 cycles under simulated aerodynamic loads and system kinematic conditions equivalent to 3,000 psi and 450 F.

Fig 2 shows a new approach to the metallic sealing of hydraulic systems operating at 4,000 psi and above, and in temperatures from 65 F to 750 F (or more). The design of this all-metal seal produces compression loads, this giving positive dynamic and static sealing. ★



These hands are your biggest investment

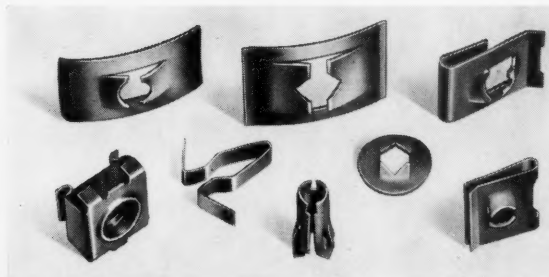
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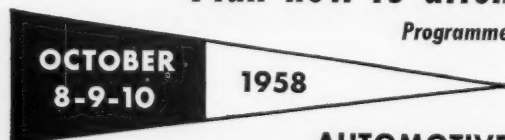
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Briefs

We note with interest . . .

A British firm has developed a photo-electric unit, which gives early detection of dangerous conditions (the over-production of oil mist) in diesel engine crankcases . . . that a 2v 8 amp-hr cell which is completely unspillable is now available. Filled and charged, this compact cell weighs only 21 oz. . . the gradual arrival on the Canadian scene of stereophonic high fidelity equipment, which can take three separate sounds out of a single groove . . . Westinghouse's announcement of an induction heater suitable for laboratory research and other work . . . a round-America demonstration flight by a Bristol Orpheus-powered Lockheed Jetstar transport in a flying time of 15 hours at an average speed of 440 mph . . . the coming of the Institute of Radio Engineers 1958 convention and exposition in Toronto on October 8, 9 and 10 . . . the use of an alloy of copper, nickel and iron to produce permanent magnets as small in diameter as a human hair . . . the giving of the Sperry Award to a non-American engineer or engineering team for the first time—the 1958 Award went to Dr. Heinz Nordhoff, Director General of the Volkswagenwerk and the late Dr. Ferdinand Porsche, designer of the Volkswagen . . . that an American company has a new decorative one-coat organic finish which is reputed to cost 80% less than plating and 50% less than anodizing . . . the claim of a US company to have produced the world's thinnest gold alloy strip (only 80 millionths of an inch thick) for use as a non-magnetic gap in magnetic recording heads for modern stereo and monaural hi-fi equipment . . . the Comet Four has been excluded from the ban on four-jet airliners imposed by the authorities at Idlewild Airport, N.Y.—the new British airliner is far more soundless in taking off and landing than a DC7 or a Super Constellation . . . the Standards Engineers Society's scheduling of their seventh annual meeting for September 22 to 24 in Philadelphia—theme of the meeting will be "standardization, a must for the space age" . . . the development by British engineers of an anti-skid breaking system for automobiles similar to that used on many civil and military aircraft . . . plans by Dow Chemical for producing linear polyethylene at Sarnia, Ontario by 1959.

DESIGN ENGINEERING SEPTEMBER 1958

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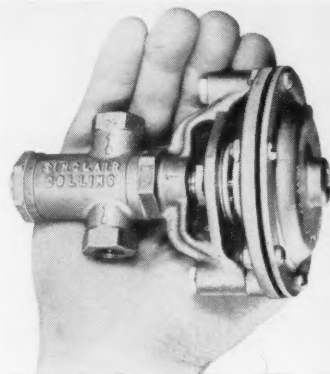
BUTLER 6-4411 or telephone LOCAL 2561

New Products

3-way valve

A 1/4-in., 125 psi 3-way valve designed for steam, hot and cold water, air and gas service has been announced by the Sinclair-Collins Valve Co.

The diaphragm-operated valve is said to offer compact design, simple installa-



tion, leak-free performance, low initial cost and minimum maintenance.

Body, yoke, ring and piston are cast Navy M bronze with a cast iron body optional. Disc holders and gland nuts are bar brass, the stem is stainless steel and the spring chrome silicon steel. (217)

Magnetic holders

A range of these magnetic bases are now available with various attachments which make them suitable for use as holders for indicators, inspection lamps, magnifiers and so forth. The price of these



bases (which are built around Alnico magnets giving a 50 lb pull) ranges from \$4.75 up to \$9.50 for the model giving precision lateral adjustment by thumb screws. (218)

(Continued on page 80)

Pelikan

TOP QUALITY DRAWING AIDS



Chin-Chin

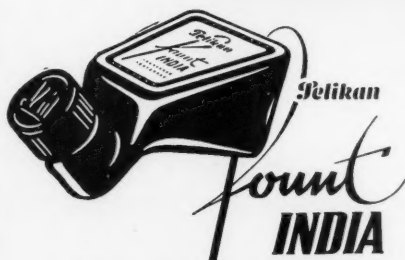
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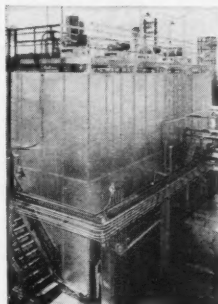
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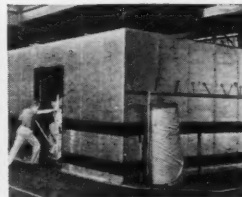
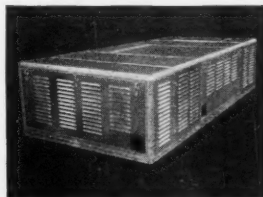
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New Products

Continued

Replaceable metal filters

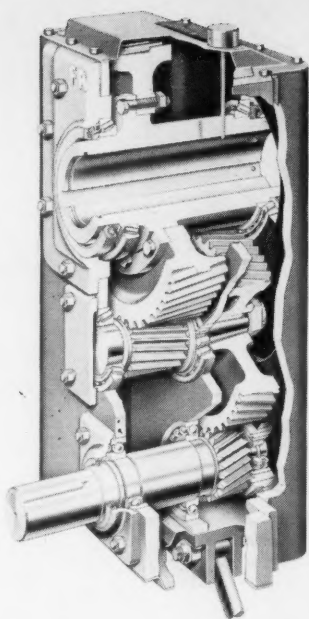
Replaceable metal bowl filters (manufactured by the C. A. Norgren Co.) offer improved filtering efficiency for $\frac{3}{4}$ in. and 1 in. air lines where temperatures reach 200 deg F and 300 deg F or where pressures go as high as 250 psi. The new metal bowl models, furnished with either automatic or manual

drain, embody a directional louver which creates a strong centrifugal action for efficient removal of corrosive liquids from the air stream. (219)

Shaft Mounted Drive

The Falk Corp. has added a larger size to its line of shaft mounted drives. The new unit is available in single reduction ratio of 5:1 and in two double reduction ratios, 14:1 or 25:1. Ratings range from 2 hp at 5 rpm to 50 hp at 359 rpm; maximum torque rating at low speed shaft is 31,000 lb. in.

The longer centre distance between shafts allows using larger sheaves on in-

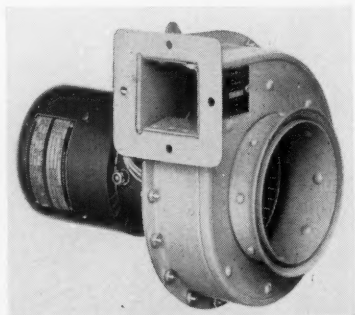


stallations where the unit is mounted with input shaft toward driven machine, or on the three-wall, one piece housing permits inspection of bearings and helical gears. An automotive-type dip stick is provided to check oil level quickly. (220)

Blower unit

The new aircraft blower unit announced by the Torrington Manufacturing Company of Canada Ltd. has been designed for airborne operation at high speeds and against high pressures not previously possible in blowers of this size. The units deliver 175 cfm of air against an operating pressure of 16 inches of water and can be used in a temperature range from -75 F to 160 F. Cooling of electronic equipment, cabin pressurizing and windshield defrosting are typical airborne applications for the new blower unit, which meets all the environmental specifications of MIL-E-5272A.

The totally enclosed, explosionproof 1.2 hp aircraft motor furnished with the unit operates with a 4-pin-type connector on a 200v, 400 cps system and at speeds up to 11,000 rpm. The unit weighs 8 lb and occupies a space of less than 8 x 8 x 9 in. (221)



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*All sizes. Prompt service from stock!
For production and maintenance.*

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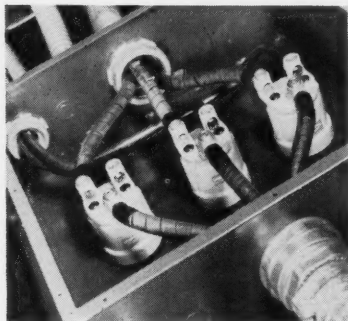
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Junction box

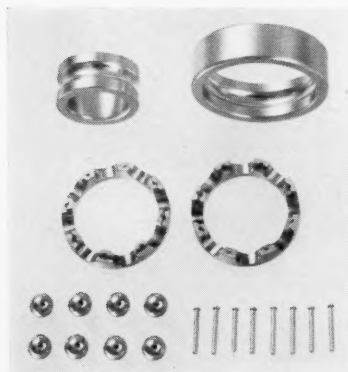
This new 5kv junction box has 5kv fibre glass reinforced polyester standoff insulators instead of conventional porcelain insulators. The new insulator eliminates two problems often encountered with porcelain — chipping, especially during handling and shipment, and



loosening of the leaded inserts. In addition, these insulators weigh less and have greater dimensional accuracy which eliminates expensive hand shimming and fit up. The junction box itself cuts down on expensive splicing operations and may be installed by a journeyman electrician. The insulators are manufactured by the **Glastic Corporation**. (222)

900 F ballbearings

Industrial Tectonics, Inc. has a line of antifriction bearings suitable for operation in ambient temperatures up to 900 F. They are deep groove radial ball bearings, and are available from stock in four sizes; 200, 202, 204, and 206. The company believes these to be the



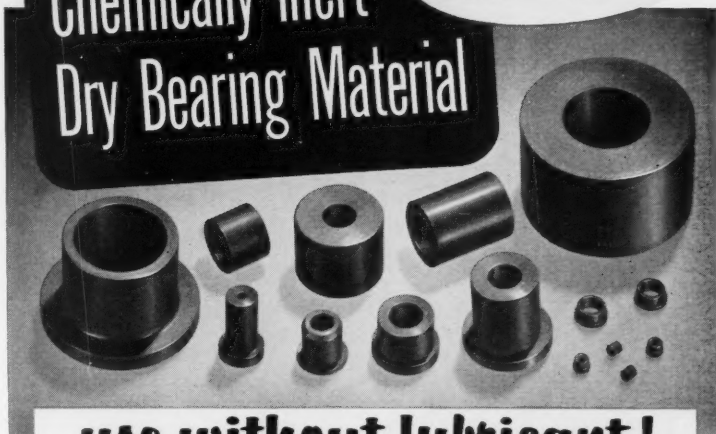
first high temperature ball bearings ever carried in stock, in a range of sizes, by any bearing manufacturer.

Both inner and outer races are M-2 high-speed steel. The riveted machined retainer is land riding, and is manufactured from either S-Monel or heat-treated M-2. Balls are M-10 high-speed steel. The bearings operate at speeds up to 40,000 rpm without lubrication. (223)

Continued on page 84

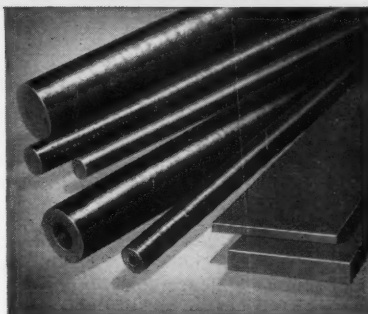
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Request Bulletin T-120 and Price Sheet No. 126, or send b/p or specs. for quotation on molded or machined parts.

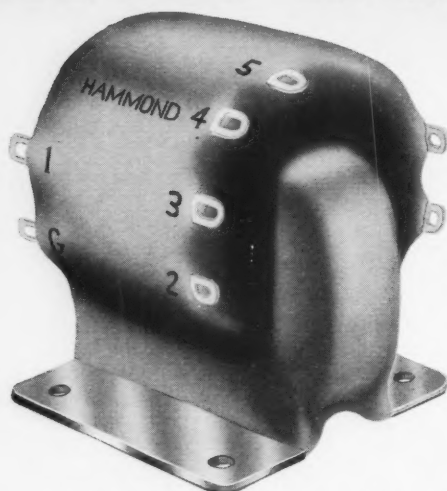
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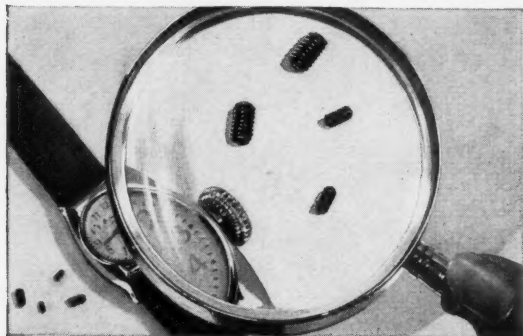


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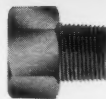
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The outside diameter of the box end of this wrench is being polished with a simple fixture and one pass on a Metalite coated abrasive belt. The result of this "Abrasive Tech" method is fast, consistent polishing, since rotation and pressure of the wrench against the belt are always uniform.

Our well-equipped "Abrasive Tech" Methods Room is available to solve your finishing problems. Call or write Behr-Manning (Canada) Limited, Brantford, Ontario, for further information.

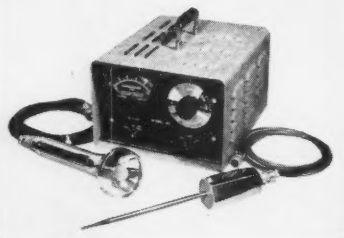


New products

continued

Vibration analyzer

A new vibration analyzer, machinery trouble-shooter, portable balancer, and vibration monitoring system has been announced by the International Research and Development Corp. This model incorporates the latest electronic technology to reduce machinery wear, poor machine performance, chatter, and in-

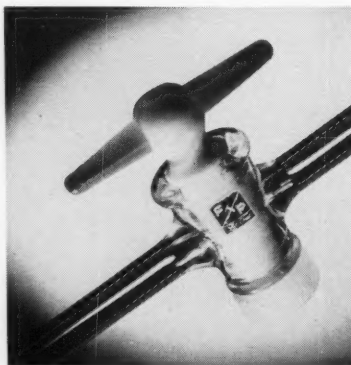


terrupted production caused by vibration and imbalance.

The analyzer affords new dimensions in efficiency of maintenance, production, quality control, and engineering and research; it offers three instruments in one, namely a vibration analyzer, a portable in-place balancer, and a system to monitor vibration in machinery. (224)

Stopcock

Fischer & Porter Co. has developed a new low-cost 1/4-in. high-pressure stopcock suitable for glass pipe applications. The new 6mm size stopcocks, a recent addition to the company's line, cost less than ordinary high-pressure

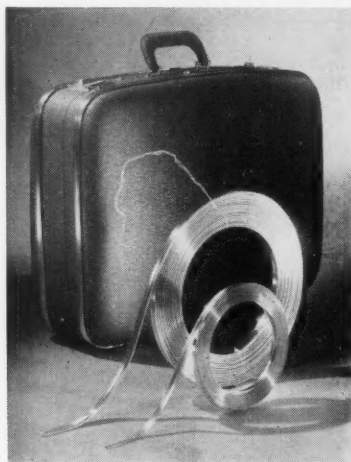


stopcocks and are leakproof and freeze-proof. They require no lubrication or grease of any kind. Since they are made entirely of inert materials and no grease is used, product contamination is eliminated. (225)

Plastic trim

A tough and colorful trim made by specially developed lamination extrusion of metallic foil with varied color thermoplastics, does away with complicated assemblies in luggage finishing, and a variety of other edging uses. Some of these other uses are on lamp shades, lighting fixtures, radios, television sets, and marine equipment, says **Glass Laboratories Inc.**

The new edging is available in gold, copper, brass, chrome, or silver effects. It maintains its high metallic luster be-



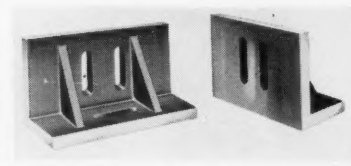
cause the metal foil is locked in between two thicknesses of extruded thermoplastic, either crystal clear or colored transparent. In addition to being tough, the plastic is also highly resistant to salt water and other corrosive elements and has good dimensional stability.

The trim is highly flexible and can be form-fitted around glass, wood, or spun metals in continuous strips. It can be mitered with ordinary household shears for angle applications, and is readily nailed or cemented to flat surfaces. (226)

Slotted angle plates

New slotted angle plates which provide slotted bolt holes on both sides, so that work can be clamped to the plate and the plate to the bed of a machine, have been announced by the **Challenge Machinery Co.**

The plates are of a special analysis semi-steel and are square and accurate



to within .0005 in. in 6 in. Eight standard sizes of the new angle plates ranging from 4 x 5 1/2 x 5 in. to 16 x 18 x 20 in. are being offered with special sizes made to order. (227)

(Continued on page 86)

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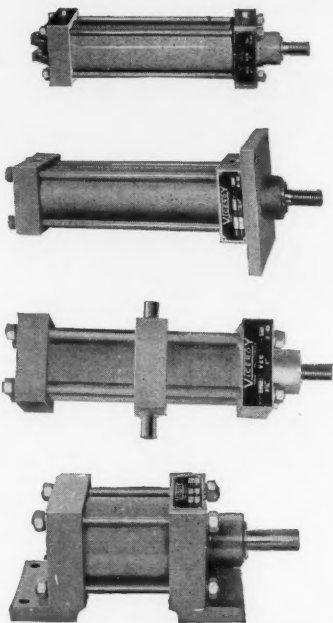
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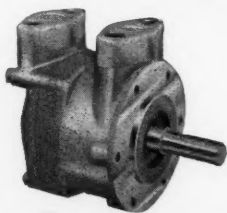
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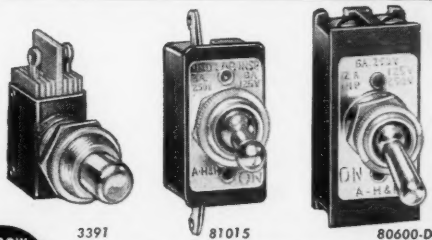
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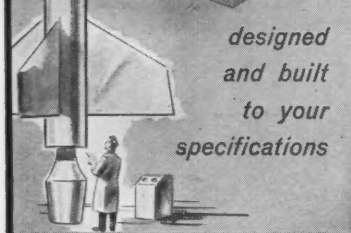
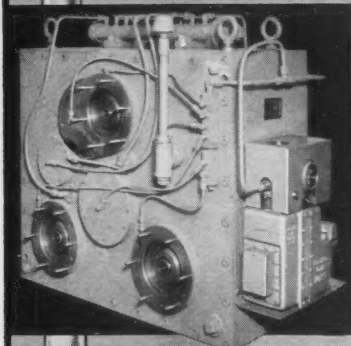


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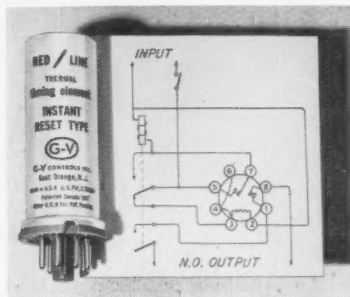


New products & materials

continued

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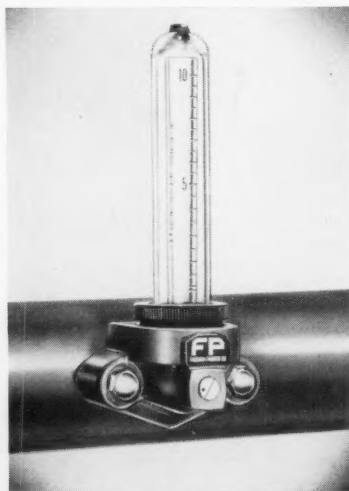


for the circuit voltage used, is ordinarily supplied by the user and mounted in the most convenient location.

The delay interval comprises a short heating period followed by a longer cooling period, leaving the thermal element cool and ready for another cycle. The thermal element has two sets of contacts. One set closes when the heating interval is complete to pull in the magnetic relay and cut off the heater. The second set makes the output circuit at the end of the cooling interval. (229)

Indicating flowmeter

Fischer & Porter Company has introduced a new type of indicating flowmeter called the Mighty-I that measures flow



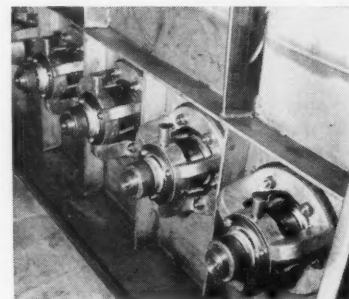
in either direction and in any pipe size from 1½ in. to 8 in. without the use of additional components or accessories. The corrosion-resistant flowmeter requires no flanges or matching orifice plates and is easily installed in any line

in a matter of minutes. Designed primarily for swimming pool filter operation, the unit is suitable for other services with flow ranges up to 10 to 1. Readings are made directly by means of a ball float and a linear scale calibrated in gpm. Scales cover flow rates from 3-30 gpm to 200-2000 gpm. (230)

Seal unit

A new face seal and bearing support, designed to provide installation and maintenance savings for immersed rolls, rotors and shafts has been introduced by the **Rodney-Hunt Machine Company.**

This seal unit is particularly suitable for application under conditions found



in the textile, paper and similar process industries.

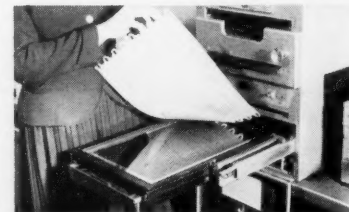
Company engineers report the new product acts as an effective and relatively frictionless seal against leakage, yet its design permits external mounting of shaft bearings. The seal is said to eliminate scoring and damage to costly shafts which is frequently encountered when a stuffing box is used. (231)

Master offset plates

Metal offset masters can now be prepared in an operation taking only four minutes.

The development adds a new dimension to the versatile xerography copying process.

Field tests with unsensitized aluminum offset masters indicate runs of 100,000



and more. Run-off copies are clean and sharp, and the metal masters are easily stored or filed for re-use.

Costs average 50 cents per finished master, including labor. (232)

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173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190

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200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223
224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247
248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271
272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319
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173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190

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200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223
224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247
248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271
272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319
320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343
344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367

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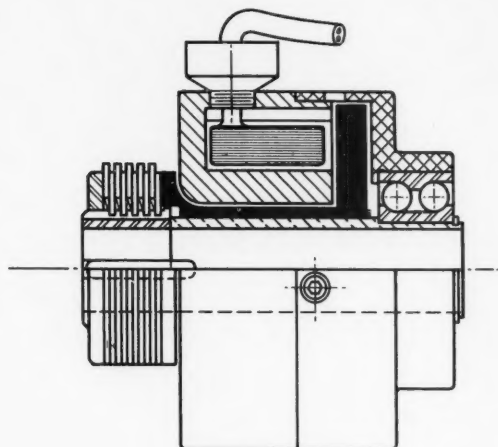
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Ideas round-up continued

Electric clutch: simple and practical



For several years, engineers of **The Carlyle Johnston Machine Company** have been working on the basic design of a simple and practical electric clutch embodying the company's standard Maxitorq floating disc clutch units, either wet or dry type. Production of the electric floating disc clutch is now announced in a full range of standard sizes, both single and double types.

The new clutch consists essentially of a sealed magnetic coil enclosed in the clutch housing and acting through a sleeve and pressure plate to compress the clutch discs. An important feature of the design is that the electro-magnetic actuating mechanism is stationary. Positive pressure is exerted and maintained on the clutch discs entirely by means of the magnetic flux, and there is no mechanical contact between the moving and stationary parts. Consequently, there is no wear on these parts. An important feature of the design is that the magnetic flux (and, of course, the pressure exerted on the clutch discs) can be precisely controlled by varying the voltage. The electric clutch therefore opens up a wide range of new application possibilities where it may be desirable to pick up (or slow down) a load gradually from a remote station. Other applications include use as a "dead man" type of control in conjunction with safety devices. Fully controllable positive action (combined with compactness and simple wiring) suggests broad use in automated equipment installations. (233)



"Select from the quality Gast Line," says C. E. Bradley, Asst. Sales Mgr.

For long-lived high performance, get GAST AIR PUMPS

Here's the broad Gast Line of Air Compressors. Vacuum Pumps, too, are made in all these models. Capacities from .6 to 45 cfm., pressures to 30 psi., vacuum to 28" Hg. Rotary-vane design is simple, efficient, dependable. Positive, pulseless air delivery—no tank needed. For plant use or O.E.M., get Gast quality!

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Grease: high tenacity keeps it on the job

By switching to a special, high-tenacity grease for the open gears on its rolling mills, a large metalworking plant has eliminated a troublesome problem of grease throw-off.

The difficulty was to keep lubricant on the 10 ft diameter bull gears of large break-down rolling mills. With pinion gears turning at the normal operating speed of 800 rpm, all previous lubricants flew off. This caused such troublesome and inefficient conditions as wasted grease, messy work areas, slippery floors, excessive gear wear, premature machine break down and increased fire hazards. On top of all this, lubrication costs were excessive: gears had to be relubricated once a week. To eliminate these troubles, the plant superintendent sought a lubricant that would provide essential lubricating qualities and still cling to gear surfaces at operating speeds. Keystone 29 X Light open gear grease (manufactured by **Keystone Lubricating Co.**) met these requirements and brought about an immediate improvement. Throw-off was virtually eliminated and lubrication frequency was reduced from an average of once a week to once every six weeks.

Three weeks after its application, the gears were still covered with an excellent protective film of grease. Only a few specks could be seen on the guard, and the grease had not thinned out to a point where capillary attraction pulled it onto the pinion overhang.

The grease is an extremely tenacious type developed specially for open gears in strenuous service. High

speed pressure or heat will not make it thin out, throw off or squeeze away. It provides a highly adhesive lubricating film that reduces wear, dampens noise, increases gear life and lowers power consumption. It also resists acids and alkalies and provides effective lubrication through a wide range of temperature. (234)



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No time like the present

LOTS OF YOU ENGINEERS have the nucleus of an article tucked away in a drawer somewhere, either in the form of rough notes or as a rough typescript.

The reason, of course, that you haven't done anything about it is because you probably feel that nobody will be interested in publishing it—so why do all the work necessary to get it in shape for nothing?

There is somebody interested in your technical article: **DESIGN ENGINEERING** is always on the lookout for suitable contributions. Not that we are short of material, mind you. But it does seem a pity that good stuff should not see the light of day.

Why not act at once and tidy up that article, get it typed and submit it to **DESIGN ENGINEERING**? If we like it enough to publish it, you will be paid. Not a fortune, perhaps, but enough to make it worth your while.

And think of the personal satisfaction of seeing yourself in print.

Advertising Index — September

101	Aluminum Co. of Canada Ltd.	IFC
102	Arrow-Hart & Hegeman (Canada) Ltd.	85
103	Atlas Steels Ltd.	41
104	Avro Aircraft Ltd.	78
105	Bakelite Div. of Union Carbide Canada Ltd.	37
106	Behr Manning Ltd.	84
107	Bristol Co. of Canada Ltd.	83
108	Brown (Canada) Ltd., David	44
109	Burndy Canada Ltd.	28
110	Canada Iron Foundries Ltd.	7
111	Canada Iron Foundries Ltd.	18
112	Canadian General Electric Co. Ltd.	43
113	Canadian I.R.E. Convention	76
114	Canadian Johns-Manville Co. Ltd.	71
115	Chicago Rawhide Mfg. Co. of Canada Ltd.	83
116	Clearprint Paper Co.	27
117	Crane Packing Company	81
118	Cyanamid of Canada Ltd.	42
119	Daystrom Ltd.	14
120	Dominion Engineering Co. Ltd.	12
121	Dominion Fasteners Ltd.	75
122	Dominion Forge Ltd.	16
123	DuPont Co. of Canada Ltd.	39
124	Dycon Ltd.	85
125	Esco Ltd. of Canada	2
126	Fischer Bearings Mfg. Ltd.	38
127	Flodar Corp.	83
128	Gast Manufacturing Corp.	89
129	Glidden Co. Ltd.	17
130	Hammond Manufacturing Co. Ltd.	82
131	Heim Company	8
132	Heinz Jordan and Co. Ltd.	79
133	Hoover Company Ltd.	89
134	Imperial Brass Mfg. Co.	9
135	International Nickel Co. of Canada Ltd.	23
136	Lindsay International Ltd.	79
137	Link-Belt Ltd.	13
138	Miniature Precision Bearings Inc.	33
139	National Fibre Co. of Canada Ltd.	40
140	Noranda Copper & Brass Ltd.	34
141	Orenda Engines Ltd.	IBC
142	Parker Rust Proof Co.	25
143	Peacock Brothers Ltd.	20
144	Pedlar People Ltd., The	26
145	Polymer Corp. Ltd.	OBC
146	Potter & Brumfield Mfg. Co. Inc.	24
147	Precision Rubber Products (Canada) Ltd.	91
148	Rawlplug Products (Canada) Ltd.	82
149	R & M Bearings Canada Ltd.	80
150	Saginaw Steering Gear Corp. (General Motors Corp.)	11
151	Skinner Electric Valve Div.	35
152	Snow-Nabstedt Gear Corp., The	86
153	Spaulding Fibre of Canada Ltd.	29
154	Split Ball Bearing Co.	82
155	Sperry Gyroscope Co. of Canada Ltd.	21
156	Standard Tube & T. I. Ltd.	30
157	Steel Co. of Canada Ltd.	31
158	Stratoflex of Canada Inc.	90
159	Superior Tube Company	4
160	Timken Roller Bearing Co.	69
161	Torrington Company	36
162	Torrington Mfg. Co. of Canada Ltd.	15
163	Union Carbide Canada Limited	37
164	United Steel Corp.	22
165	Veeder-Root of Canada Ltd.	32
166	Viceroy Mfg. Co. Ltd.	85
167	Vickers-Sperry of Canada Ltd.	10
168	Victor Mfg. & Gasket Co.	19
169	Ward Leonard of Canada Ltd.	73

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Editorial

Don't be afraid of coming forward

In a forthcoming issue of Design Engineering we plan to give details of a first-class Canadian appliance design. Completely designed and manufactured here, the item is a vacuum cleaner just on the market.

We are at all times on the lookout for items of Canadian design but it is sometimes very difficult for us to unearth them, for one reason or another. We hope that any companies that have new designs well on the way will let us have information, so that we can have an article on the subject and thus let other design engineers see what is going on.

In this particular instance we were most fortunate in the co-operation we received from the company. This enabled us to put together what we consider to be a first-class presentation, for not only does it point out all the important engineering features, but it shows them in a way that is easy on the eye.

We propose to collect information of this kind for use in future issues of the magazine and urge companies to let us have design details for this purpose whenever they can.

Industrial Design

We understand that final plans have now been made for the establishment of a new department of product design at North Carolina State College.

The main object of the new department will be to train students to design industrial products.

The department will be headed by Austin R. Baer, a grand prize winner of the "Versatility in Design" competition in 1956 and well known for his writings on the development of new products and the processes for making them.

The new department will be dedicated to bringing fresh, creative and original thinking to the product problems of industry.

There will be a comprehensive five-year course of study for the degree of Bachelor of Product Design and graduates of the new course will design furniture, textiles, ceramics, utensils, appliances, automobiles and so forth.

William Morse



INTAKE TO THE FUTURE

Beyond this screen, which straightens turbulent air flows, Orenda can test run advanced engines in an atmosphere equivalent to 100,000 feet of altitude.

This new high altitude tunnel is another of the major programs at Orenda for research into air-breathing engines over the widest range of speed and altitude.

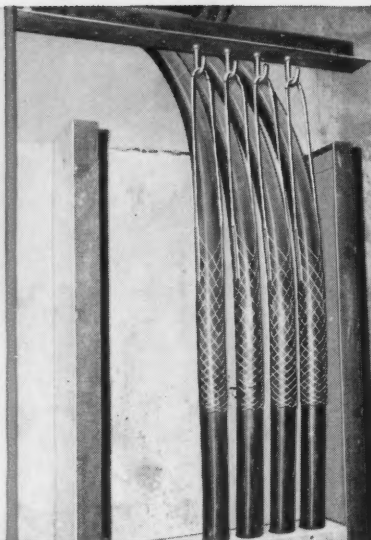


ENGINES LIMITED MALTON, CANADA

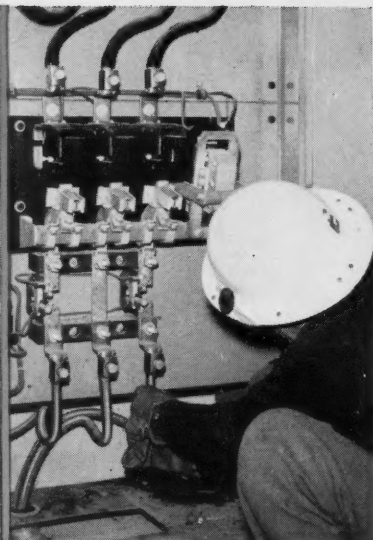
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The Polysar Butyl-insulated low voltage cable built by Pirelli Cables is a 3-conductor 600 MCM power cable operating at 600 volts.



Parts of the cable installation were vertical runs, for which the above special suspension system was developed.



As the cable reaches this control panel its three conductors are connected to separate circuits. Polysar Butyl-insulated cables are easy to install and terminate.

Polysar Butyl gave Pirelli the answer to exacting needs

To carry power to elevators, pumps and lighting equipment at the Robert H. Saunders—St. Lawrence Generating Station near Cornwall, Ontario Hydro specified a cable insulation which could withstand the high temperatures generated by heavy loads and have a long life expectancy.

*Polysar Butyl was the insulation chosen to meet these specifications by Pirelli Cables Conduits Ltd., the successful tenderer.

Excellent ozone and moisture resis-

tance and ease of installation of the finished cable were further advantages which made Polysar Butyl the preferred insulation material.

Pirelli custom-built 16,000 feet, three-conductor 600 volt power cable. Each conductor is insulated with heat and ozone-resistant Polysar Butyl.

This important cable installation provides another practical example of the superior insulating qualities of Polysar Butyl.



POLYMER CORPORATION LIMITED
SARNIA • CANADA



This was the lower reach of the famous Long Sault Rapids before the river was diverted to provide a vast reservoir with an 81 foot head of water. The Robert H.

Saunders St. Lawrence generating station is shown during an early stage of construction. The station will have 16 generating units with a total capacity of 820,000 kilowatts.

